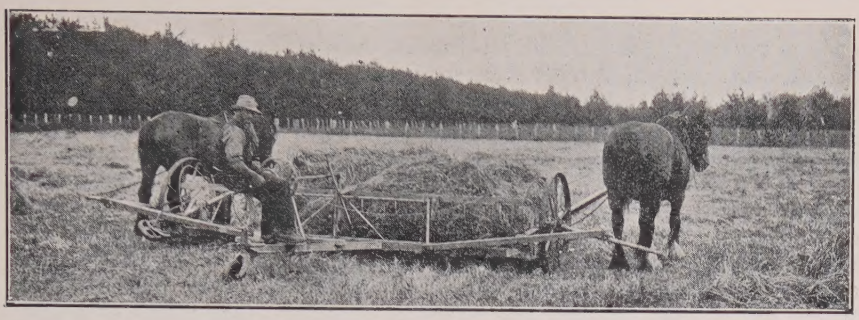

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## NAURU AND OCEAN ISLANDS.

### STORY OF THE PHOSPHATE DISCOVERIES AND WORKINGS.

ALBERT F. ELLIS, New Zealand Commissioner.

DURING the last year Nauru Island, by reason of its valuable phosphate deposits, has been brought prominently before the public eye. Previous to the war it was German territory, and therefore its future had to be decided at the Peace Conference, with the result that a mandate over the island was given to the British Empire. As regards the individual country which was to administer the mandate, there was some difficulty. Australia laid claim to the island by right of conquest and its proximity to Australia, but as it had been occupied on behalf of the Imperial Government this claim could not be held to nullify other claims. New Zealand entered a claim also, on the ground of proximity and the urgent need for guaranteed supplies of phosphate for future years. After somewhat prolonged negotiations, conducted very ably as regards New Zealand by our Prime Minister, a settlement was arrived at by which it was agreed that Great Britain, Australia, and New Zealand should work the phosphate deposits conjointly, and derive supplies on the basis of their approximate requirements. The first two countries were

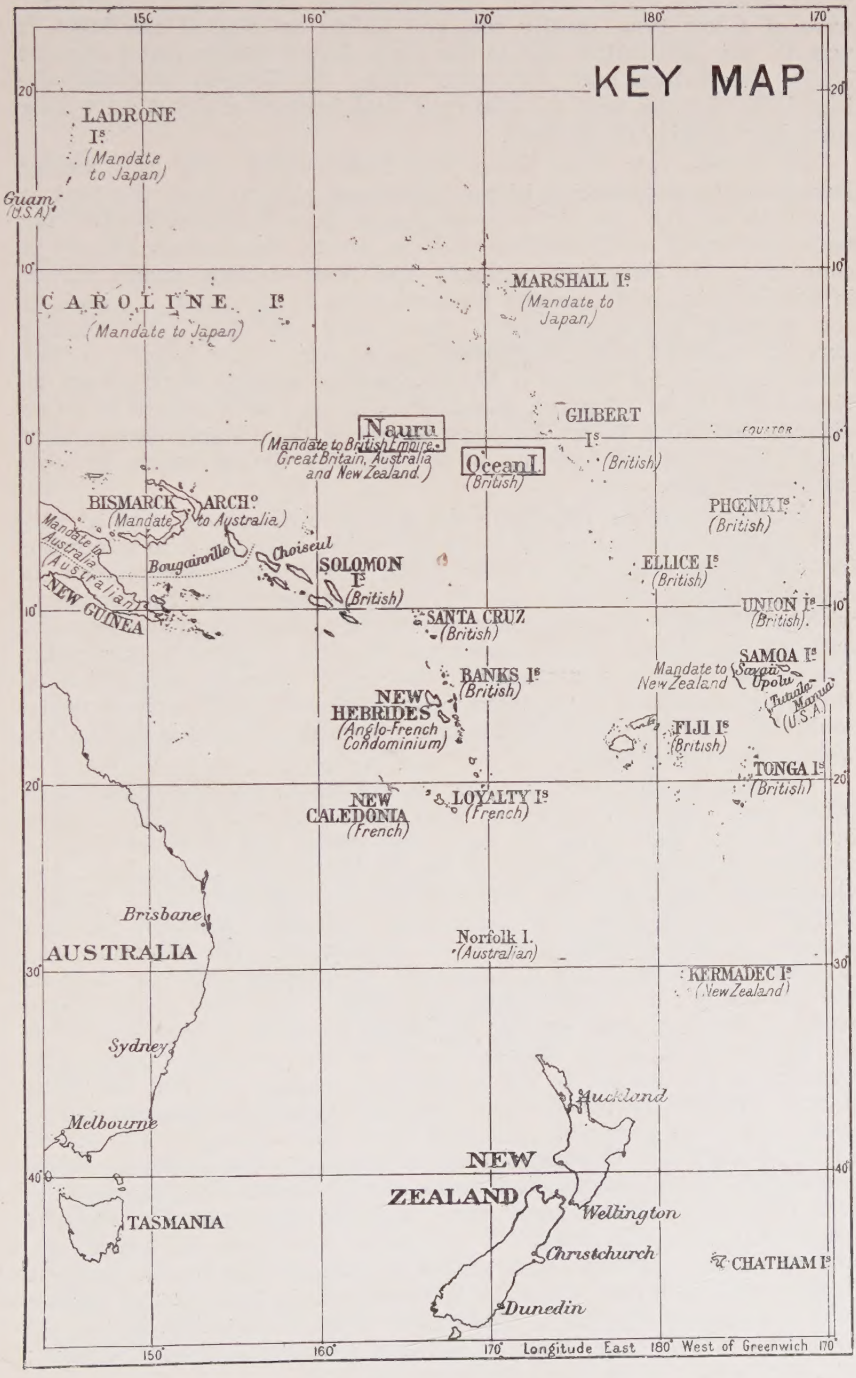
each to receive 42 per cent. of the annual output, New Zealand receiving 16 per cent. It was further agreed that these proportions were subject to revision at the end of each period of five years, and that the Pacific Phosphate Company's business at the island should be bought at a fair valuation. Such, in brief, are the main lines of the settlement.

With regard to the past history of Nauru Island, the phosphate deposit, manner of working it, prospects for the future, &c., a great deal of misapprehension exists. The place is well out of the beaten track, and the only systematic account of late years is from the pen of the Australian journalist, Mr. T. J. McMahon, who visited both Nauru and Ocean Islands, and wrote interesting descriptions of them from the standpoint of a visitor. It is proposed in these notes, written during the leisure of a long sea voyage, to describe the islands, the conditions of working, and other phases of the industry, primarily in order that the New Zealand farmer, who is so vitally interested in the subject of fertilizers, may have first-hand information regarding the industry. In describing the formation of the two islands and their deposits technical terms will be avoided, and any readers who desire to know more of the scientific aspect of the deposits are referred to a pamphlet written by Mr. F. Danvers Power, entitled "Phosphate Deposits of Ocean and Pleasant Islands." The moral of the story is embodied in the hope that the New Zealand farmer will be led to avail himself more and more fully of the wonderful Nauru and Ocean Islands phosphate, whether in the form of superphosphate or the raw finely ground phosphate. There can be no doubt that money so spent yields a good return to the farmer and benefits the Dominion generally in the form of increased production. Nauru will be dealt with first; Ocean Island resembles it in many ways, but has a different history and other features.

## NAURU OR PLEASANT ISLAND.

Originally the name "Pleasant Island" was generally used, and it is still frequently seen in maps and charts, but when the island became German territory, in the year 1888, the Germans adopted the Native name entirely. Apparently it will be commonly used in the future, though many of us older hands would prefer reverting to the original appropriate name.

The island was first discovered by Captain Fearn, of the "Hunter," in 1798, and he was said to have been so impressed by the "pleasant" features and manners of the inhabitants that he named it accordingly. They are brown-skinned, straight-haired people, apparently of Polynesian origin, and of fine physique, though, like most Pacific-islanders, lacking in stamina. At the present time they number probably twelve hundred. We have comparatively little record of their early history. Mr. F. J. Moss's book, "Through Atolls and Islands of the Great South Seas," contains a very interesting account of his visit to the island before it was occupied by the Germans. The Natives were then doing a good deal of fighting amongst themselves, principally in the form of "sniping." No doubt they were put up to it by some of the "beach-combers" or "pakeha-Maoris" living there, in order to stimulate a demand for firearms and ammunition. Mr. Moss expostulated with some of the Natives over the senseless waste of life, but was always informed that it was "the other fellow's" fault—a not uncommon plea among their


KEY MAP
150°
160°
170°
180°
170°
20°
10°
0°
30°
40°
LADRONE Is
(Mandate to Japan)
Guam (U.S.A.)
CAROLINE Is
(Mandate to Japan)
MARSHALL Is
(Mandate to Japan)
GILBERT Is
(British)
EQUATOR
Nauru
(Mandate to British Empire. Great Britain, Australia and New Zealand.)
Ocean I.
(British)
PHŒNIX Is
(British)
BISMARCK ARCHº
(Mandate to Australia)
Mandate to Australia (Australian)
NEW GUINEA
Bougainville
Choiseul
SOLOMON Is
(British)
ELLICE Is
(British)
SANTA CRUZ
(British)
UNION Is
(British)
SAMOA Is
Mandate to New Zealand
Savaii
Upolu
Tutuila
Manua
(U.S.A.)
BANKS Is
(British)
NEW HEBRIDES
(Anglo-French Condominium)
FIJI Is
(British)
TONGA Is
(British)
NEW CALEDONIA
(French)
LOYALTY Is
(French)
Brisbane
AUSTRALIA
Norfolk I.
(Australian)
KERMADEC Is
(New Zealand)
Sydney
Melbourne
Auckland
NEW ZEALAND
Wellington
Christchurch
Dunedin
TASMANIA
CHATHAM Is
Longitude East 180° West of Greenwich

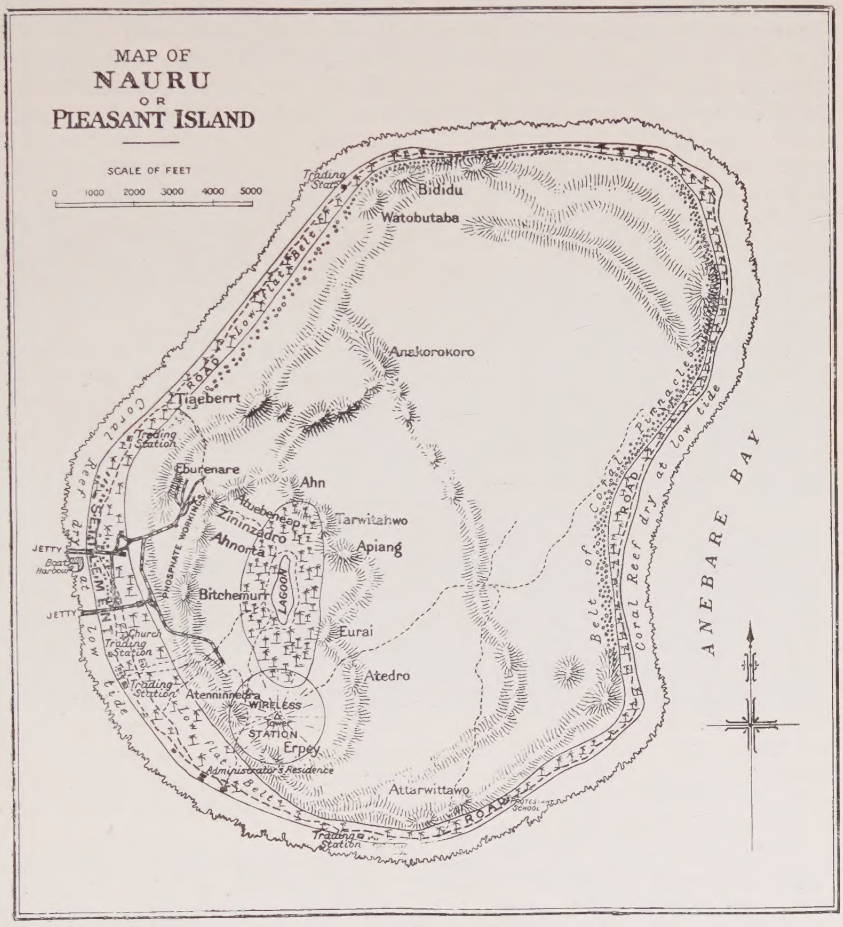
white brothers under similar circumstances. The "beach-combers" were of a low type, mostly runaway sailors or escaped convicts; it was at their instigation that in the early days a sailing-vessel was cut off by the Natives and plundered. When the Germans occupied the island the Natives were all disarmed, and intertribal fights have long since been a thing of the past.

Up to the year 1900 Nauru was looked upon only as a rather important copra-producing island, sometimes yielding over 400 tons in a suitable season. In 1876 the phosphate deposits might easily have been discovered, and definitely lost so far as the British Empire is concerned. An American company had been working guano islands in the Phœnix Group, several hundred miles to the eastward, and, as the deposits became exhausted there, they sent out a prospecting expedition in the schooner "Ariel" to examine other islands in that latitude. It is not known if the prospectors actually went ashore at Nauru and Ocean Islands, but probably, as they were known to be of different formation to the low-lying islands of the Phœnix Group, they passed them by and went on to the Marshall Group, which are also low-lying islands.

Early in 1900 the phosphate deposits were discovered, and as this took place in a rather unusual way the writer is tempted to relate the incident, particularly as, together with subsequent developments, it explains the fact that when war broke out in 1914 a British company, with headquarters in London, was working the Nauru phosphate deposits under a ninety-nine years' concession from the German Government. People had been so accustomed to hearing of German penetration of British interests that it appeared inconceivable that a British company could legitimately penetrate German interests. Nevertheless that is what actually took place.

Hitherto no first-hand account of the discovery has appeared in print, and such accounts as have been written contain various inaccuracies. Just prior to 1900 the writer had been serving as manager on one of the islands of the Pacific Islands Company on the Queensland coast, and had been transferred to the company's Sydney office, where an analytical laboratory had been installed for the purpose of dealing with samples of cargoes, &c. His attention was arrested by a large block of rock used for keeping open the door of the laboratory; in some ways it resembled a rare kind of phosphate rock, of which a small deposit had been found in a deep depression on Baker Island, in the Phœnix Group, several years previously. On mentioning the matter to the company's manager he was told that it was a lump of petrified wood found by himself on Pleasant Island some three years previously, and that one or more geologists had agreed as to its nature. This seemed decisive enough, but somehow, when working in the laboratory, that piece of rock repeatedly attracted the writer's attention, and some three months afterwards the thought occurred, "Why not test it?" A chip was knocked off, ground up, and tested for phosphate, with such a decided reaction that a complete analysis was made, and the humble door-chock proved to be phosphate rock of the highest quality. Moreover, from its formation, there were evidences that it came from an old and probably extensive deposit; as to the latter the manager was very emphatic.

The question then arose as to how control of the deposit could be obtained, and this matter was promptly taken in hand by the company's head office in London. The position was that a large German chartered company held mineral and other rights over the German Caroline and Marshall Islands north of the Equator, and also over Nauru. On the other hand, the Pacific Islands Company, who were the immediate predecessors of the Pacific Phosphate Company, held numerous coconut properties and trading-stations on the German islands which the




chartered company referred to was particularly desirous of acquiring. Negotiations ensued, with the ultimate result that the Germans acquired the trading-stations on their own islands, and the Pacific Islands Company obtained the concession to work Nauru. The Germans also received a certain number of shares in the company and a royalty per ton on the phosphate exported, so that it was a transaction which proved profitable to them, though not to the extent that it did to the Phosphate Company and to British interests generally.

Meanwhile the writer had been sent up to Ocean and Nauru Islands to ascertain the extent and quality of the deposits. The former island was included, as it was known to be of similar formation to Nauru—namely, an "elevated coral island." It was visited first, and, after a three-weeks stay there with the Natives, arrangements were made for starting operations, as will be described subsequently. Nauru was then visited with a view to "seeing everything and saying nothing," as the negotiations had not then been completed. A visit was first paid to the German Magistrate, and permission asked, through an interpreter, who had resided there for many years, to prospect the island. They were both very emphatic that there was nothing to find, saying that German warships, sometimes with scientists aboard, had visited the island annually. The desired permission was given, however, and Native guides were supplied. Proceeding inland after crossing the coconut belt on the coast, rising ground was reached, and this was seen to be phosphate country. The track was followed inland for miles, prospecting operations consisting of knocking off a piece of rock occasionally and testing it with acid, or else of scraping a hole in the ground for the same purpose. These frequent operations were watched by the Natives with blank amazement, and subsequently with smiles of pity. On returning to the settlement they informed one of the resident Europeans that the white man from the steamer was quite mad; he kept examining the rocks, pouring medicine on them and carrying away pieces in bags—a procedure so extraordinary to their minds that there could be only one explanation of it. The Nauru Natives are strong on nicknames. Accordingly the man who first poured medicine on the stones was dubbed "the stone man," and remains so to this day.

The operations of the Pacific Phosphate Company were concentrated on Ocean Island for several years, and, when the demand for its high-grade article had increased to such an extent as to exceed its capabilities, arrangements were made for working Nauru. Being German territory, it was considered expedient to appoint a manager of that nationality, but he was without experience of the unique conditions of phosphate islands, and his appointment did not prove successful. The harbour and mooring master from Ocean Island, Captain P. Theet, one of the company's oldest and most valued servants, was then placed in command, and under his experienced and energetic control Nauru was soon placed on a paying basis. He relinquished the management just before the war, having decided to "cast anchor" close to Auckland.

When war broke out in 1914 about two-thirds of the company's staff were British and the remainder were German, as also, of course, were the Government officials, supported by a considerable force of armed black police. As might be expected, complications arose before long, with the result that the German Governor ordered the Britishers, with their wives and families, off the island in a neutral vessel then lying there, which took them across to Ocean Island. Meanwhile, however, the company had been in touch with the Imperial and Australian authorities, stressing the importance of having the British flag hoisted on Nauru, and about a week after the expulsion of the British staff H.M.A.S. "Melbourne" suddenly put in an appearance there. The German Governor took a sensible view of the position

and agreed to surrender the island when called on to do so, but as there were many Chinese labourers on the island at the time the formal hoisting of the flag was postponed. Some weeks afterwards a small force of Australian soldiers was sent up in the company's chartered s.s. "Messina" to occupy the island. She proceeded first to Ocean Island, took aboard the expelled Britishers, and went across and landed them at Nauru, when the flag was hoisted with all due ceremony. The Germans were deported to Sydney, where most of them were interned. Only a few days afterwards a Japanese warship and a transport with troops arrived off Nauru for the purpose of occupying it, as had just been done with the Caroline and Marshall Groups.

Such, in brief, are the incidents in connection with the war. It goes without saying that the company's staff on both islands did their

A TYPICAL PHOSPHATE-FIELD AT NAURU ISLAND.

Most of the phosphate has been removed, thus denuding the coral pinnacles.

part as regards war work. Many left on active service, including some of the senior staff, whose services could ill be spared. Several gained decorations, and it is a gratifying fact that nearly all who survived have returned to the employ. At Ocean Island an efficient defence force was organized, as a precaution against raiders, and the members had volunteered to go across and take Nauru, but this was not encouraged by the authorities.

Promptly after the outbreak of war the London board of directors complied with the requirements of the law and gave particulars to the authorities regarding the enemy holding of shares in the company. These had been increased considerably a few years previously, owing to the fact that German capitalists promptly realized the value of the industry and bought a good many shares in the open market. In due

course these shares were advertised for sale by the Public Trustee and sold by public auction in London, being bought by a large shipping company for a considerable sum. This transaction finally cleared off all enemy interests in the phosphate company. When the British flag was hoisted phosphate operations were promptly resumed, and have since continued without a break. Under the new arrangement with the three Governments the transfer of the business has taken place as at the 1st July of this year, and so it may be considered that the Pacific Phosphate Company is off the scene. The business has been taken over as a going concern, and the authorities concerned have indicated their desire that the company's employees should continue under the new regime as being an important factor towards the continued success of the operations.

The passing of an old-established business house cannot but be regretted by many. The Pacific Phosphate Company, with its predecessors the Pacific Islands Company and Messrs. John T. Arundel and Co., has carried on operations in various parts of the Pacific for nearly fifty years, and those who know most about the business will agree that the honourable conduct of its operations has been equalled only by the enterprise shown in the face of many unique difficulties. Up to the year 1900 the company's operations were on a comparatively small scale; only small deposits of phosphate—or "guano," as it was then called—were available, and each island was worked out in two or three years, necessitating shifting to another. This meant that there was very little money in the business; but in 1900 the company figuratively "struck oil."

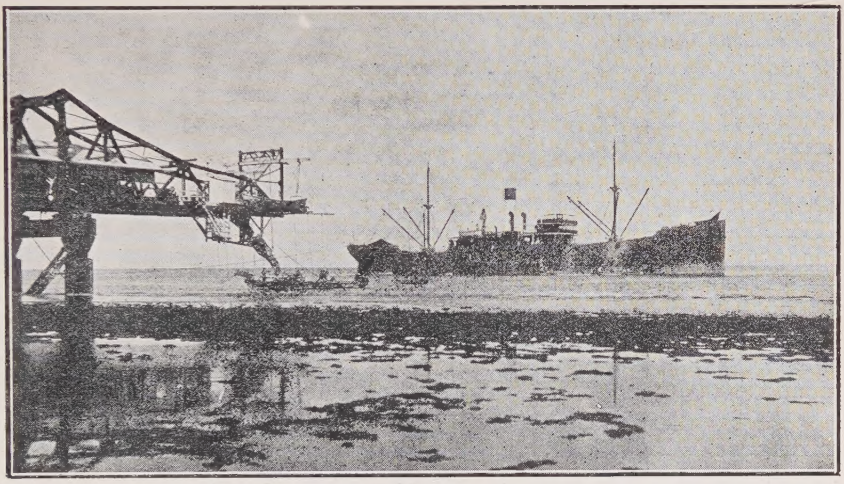
It need hardly be said that the taking-over of the business by the three countries referred to was not done by the wish of the company. However, there are many things to take into consideration, and there is little doubt that future years will justify this altogether unprecedented arrangement. It is singular that the British Empire, so rich in natural resources generally, is not rich in known phosphate deposits. There is a moderate-sized deposit of high grade at Christmas Island, in the Indian Ocean, and deposits of medium quality in Egypt. With the exception of these, other known deposits within the Empire are unimportant. We do not know what the future may bring forth, and there can be little doubt as to the wisdom of conserving the wonderful deposits of Nauru and Ocean Islands for the benefit of the Empire. For some time past the United States has taken steps to conserve a large proportion of its deposits.

Some adverse comment has been made regarding the sum paid to the company as compensation—three and a half millions sterling. Apart, however, from the question of the enormous deposits and the profits which would have been made by the company in working them, it must be borne in mind that there is an elaborate plant at each island. The erection of this alone, under present conditions, would absorb the best part of the sum referred to.

On referring to the accompanying key map the locality of Nauru and Ocean Islands will be seen. They are 160 miles apart, and are situated nearly due north from New Zealand, within one degree of the Equator. Nauru is approximately eleven miles in circumference, three miles and three-quarters long, and two miles and three-quarters wide, the area being nearly 5,000 acres. A flat fringing reef, from 100 to

200 yards in width, surrounds the island, and this is dry at low tide. Above the reef is the white sandy coral beach, and then a flat sandy belt running round the island, varying in width from about 30 yards on the eastern side to over 400 yards on the western, where the settlement is situated. This belt is an unbroken coconut grove, with the Natives' huts interspersed through it. A good road has been made right round the coast, mostly in the shade of the coconuts, and it is a pleasurable experience to run round in the car used for collecting the copra. In many ways Nauru is a beautiful island, and were it closer to New Zealand would attract an embarrassing number of visitors by reason of its picturesque scenery, interesting Native inhabitants, and unique industry.

Beyond the flat coconut belt comes the phosphate country, mostly at an elevation of about 100 ft., with hills here and there, the highest being about 210 ft. above sea-level.



STEAMER LOADING PHOSPHATE AT NAURU ISLAND.

Lighter ready to take its load at end of steel cantilever jetty. Low tide on the reef.

A noticeable feature is the lagoon, with its surrounding dense coconut grove, and what is known as the "bush village." This lagoon is slightly brackish, so evidently it has subterranean connection with the sea. It is carefully divided up into sections by means of barriers of coconut-leaves placed on top of each other, thus forming a low fence. Each section is owned by a family or group of families, and has been handed down by their ancestors. They guard their rights to these sections even more zealously than they do their coconut lands. The lagoon is, in fact, a valuable preserve for cultivating fish. On the ocean reef the spawn of a certain kind of fish is caught and carried across to the lagoon in coconut-shells. In a comparatively short time the spawn develops into fine fish 1 ft. to 2 ft. in length. If allowed to remain longer they have been known to grow to 4 ft. Nothing is done in the way of feeding them, and they thrive so well on what they find that

it is possible to fry them in their own fat. When the bush-village Native goes for his morning bath, by taking a small scoop-net with him he can bring ashore fish for breakfast.

With the exception of the lagoon and surrounding coconut grove the interior is practically waste land, with clumps of bush trees and scrub here and there. The Native way of growing water-melons there is interesting. Well away from the villages, where the pigs are always foraging, a man will set fire to a fallen tree, and afterwards drop a few seeds in the ashes. No further attention is required, and in due course a crop of really good water-melons is obtained. The potash in the wood-ashes, combined with a sufficiency of phosphate, is, of course, the secret.

There is no soil on Nauru in the ordinary sense of the word; it is all phosphate, except, of course, on the coastal belt. The vegetation grows right out of the phosphate, and, provided there is adequate rainfall, it thrives. One would think that such high-grade material would be too rich for plant-life, but it is in the insoluble tribasic-phosphate-of-lime form. The roots, either by means of their acid secretions or through the organic acids in the soils rendering a portion of the phosphate soluble, take up enough for their requirements, and the excess which is present does not have any prejudicial effect on their growth.

Though the phosphate deposits extend over the whole of the interior it does not follow that there is nothing else but phosphate. The bed-rock of the island is coral limestone, of a hard compact nature and strange pinnacle form. The pinnacles vary in height from a few feet to 30 ft. or even more. They are supposed to have been formed by the action of the sea in first forming caves, the roofs of which wore thinner and thinner until they fell in, leaving the walls standing. These in places wore through, and the pillars gradually assumed the pinnacle form.

The phosphate is found in between the pinnacles and often covering them entirely. When a new "workings" is started there may not be the top of a single pinnacle in sight, but as the phosphate is removed plenty of them soon appear. The question naturally arises, How did the phosphate come there? What may be called the "bird theory" is usually looked on as the most probable one. If correct, the locality must have been the habitat of myriads of sea-birds—to a much greater extent that it is now. In that case the soluble phosphates from their excreta would combine with the lime in the underlying coral rock, becoming fixed as tribasic phosphate of lime. We can tell by observing the terraces on the island and by examining the formation of the phosphate rock that the island has been depressed below the sea and elevated several times. For instance, water-worn phosphate pebbles consisting of smaller water-worn fragments may be found, and this conglomerate rock affords proof of subsidence. The alternate submerging and elevating processes which Nauru and Ocean Islands have been subject to in bygone ages have been the means of washing out all the carbonate-of-lime impurities, thus producing a deposit which for richness is almost phenomenal. The islands have, in fact, been a vast laboratory in which nature by her wonderful methods has made provision for the needs of humanity.

The bird theory is open to objections. Though all sorts of fossil marine organisms are found in the phosphate—corals, shells, sea-urchins, and sharks' teeth and bones—we never by any chance find remains of birds' bones or eggs. Patches of phosphate rock have also been found, under puzzling conditions, when excavating on the ocean reef. However, for want of a better, we accept the bird theory.

The phosphate exists mostly in a form and colour similar to our New Zealand gravel, but here and there we find enormous boulders of phosphate rock, sometimes weighing several tons, and these have to be blasted up with explosives. This rock is of varying degrees of hardness, there being quite an extensive variety of formations. Sometimes the boulders have previously been a particular kind of coral, called by sailors "niggers' heads" or "horses' heads." Through being buried in the phosphate for so long chemical action has set in;

STREET AT THE PHOSPHATE SETTLEMENT, NAURU, SHOWING THE UNMARRIED-STAFF HOUSES.

soluble phosphates have liberated the carbon dioxide from the coral and have combined with the lime, forming a phosphate rock quite as rich as the rest of the deposit, while the original structure of the coral is retained. A change takes place in the colour of the material. The coral rock ordinarily is white; when "phosphatized" it becomes brown or sometimes grey. There is no smell or unpleasantness about the phosphate other than its dustiness, which cannot be considered a fault, and which has no harmful result.

Cargoes of Nauru phosphate run from 85 to 86 per cent. tribasic phosphate of lime. Occasionally patches running as high as 87 per cent. to 88 per cent. may be met, but in working it is found advisable to mix all together. There is no low grade, and it would be impossible to ship a cargo running below 80 per cent. unless impurities were deliberately mixed in. Some of the phosphatic fertilizer brought into

New Zealand from other sources depends for its value on about 30 per cent. of tribasic phosphate; other well-known brands contain 62 per cent. It will therefore be seen that the Nauru article is excellent, and it is expected that New Zealand farmers will give decided preference to it, whether in the form of superphosphate or finely ground raw phosphate.

When we consider the great expense incurred by the farmer in freighting his fertilizer, whether by sea, rail, or road, it must be evident that in handling a high-grade article a very great saving is effected, a ton of Nauru phosphate containing more phosphate of lime than 2 tons of a certain other brand. It may be contended that sometimes when a high-grade fertilizer and a low-grade are tried against each other the latter gives equal results. This, however, may be misleading, as there are other factors in the soil which may have a bearing on the subject; but there can be no doubt that what the soil wants is phosphate, and the high-grade article, bulk for bulk, supplies the greater quantity. It may also be contended that the carbonate of lime in low-grade fertilizers is a valuable constituent. There is, however, plenty of carbonate of lime in New Zealand without bringing it from overseas, and the farmer can buy it locally, with the advantage of getting it freight free by railway up to 100 miles.

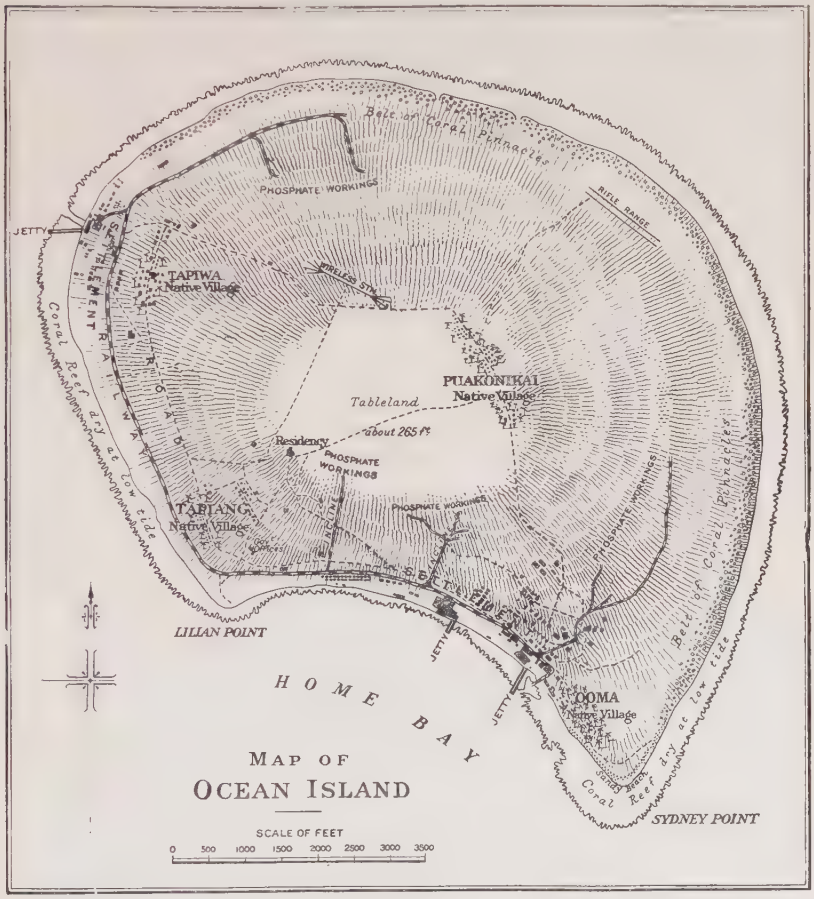
With regard to the total quantity of phosphate available on Nauru, owing to the uneven nature of the deposit occasioned by the pinnacle formation it is impossible definitely to calculate the tonnage. The original estimate was in the neighbourhood of 50,000,000 tons, but there is good reason to think that there is at least half as much again.

We will now proceed to follow the phosphate from the "field" to the ship. It might be supposed that, as the quantity is so large and there is deep water close in, all that remains to be done is to put the vessel alongside a bank and run loaded trucks right aboard at a mere nominal expense. That, unfortunately, cannot be done, and, as a matter of fact, the operations are comparatively expensive. The first thing is to strip off the vegetation, and occasionally remove a light coating of leaves and rubbish from the surface of the deposit, which is then ready for quarrying. Tram-lines are led up to it at a low level, the trucks used being of one-ton side-delivery type. As far as possible the deposit is excavated on the face, the material being shovelled directly into the trucks; or if a considerable gang of men is at work they load several trucks at a time, using either light "canal" barrows, which are dumped from wheeling-stages; or, in the case of the Chinese coolies, each man has two baskets and a pole, carried on the shoulder. The upper portion of the deposit is easily removed, but clearing out the lower levels from between the bases of the pinnacles is much slower and more difficult. A more up-to-date quarrying plant has been installed at each island in the form of a modern cableway. From two high steel towers about 200 yards apart a wire rope is suspended, and along this a traveller runs backwards and forwards; empty skips are lowered down between the pinnacles, filled with phosphate, hove up and run along to a hopper on the tram-line by means of a fast electric winch. This system has certain advantages, but so far has not supplanted the older method of barrows and baskets.

A rake of trucks having loaded up, a small locomotive then runs them along to the drier-shed, where the phosphate is dumped into the

"wet" bin. From this the material drops into rotary rock-breakers, which reduce any rock to the size of small nuts. It then passes into the artificial driers. These are large revolving cylinders about 60 ft. long with a furnace at one end. As the material passes through it is dried, and is then removed to the storage-bin by means of elevators and conveyers, being now ready for shipment.

We now come to the shipping operation, which is far and away the most difficult problem, but which has been fairly well solved. Nauru




and Ocean Islands are really mountains with their tops above the sea. The sides go down at an angle of 45 degrees, and this means that vessels cannot lie to their own anchors, simply because when they swung inshore they would inevitably come in on the reef. The difficulty has been overcome by putting down moorings, probably the deepest in the world. The outer anchor is dropped in about 180 fathoms, or 1,080 ft., and the mooring-buoy which supports the "up-and-down" portion to which the vessel moors is probably the largest size made. The laying of these moorings is a difficult and expensive matter, but a system of

doing it has been perfected by an Aucklander, Mr. G. W. W. Cozens, an old servant of the company, who has been in charge of this department for many years. The vessel lies to the mooring-buoy about three ships' lengths from the jetty, and all that is needed to give her quick despatch is ordinary fine weather.

At Nauru small electric locomotives are used for running the loaded trucks from the storage-bin to the end of the jetties, where the phosphate is dumped into a hopper. The lighters used are surf-boats carrying from 2½ to 3 tons of phosphate, which is contained in four large baskets in the middle of the boat. The Native boatmen are most expert at their work; a boat will swing in under the shoot, the door of the hopper is opened, and in less than a minute the boat is away with its load. Oil-launches tow the lighters off to the steamer, where the baskets are hove up, emptied, and returned to the lighter. In fine weather 1,000 tons can be shipped in nine hours, and frequently another shipping gang carries on after dark, when a wide-angle searchlight is used for lighting up the end of the jetty and out to the steamer. The vessels used in the trade mostly have a carrying-capacity of from 5,000 to 6,000 tons of phosphate. It is necessary to avoid having boats of a much larger size, as an undue strain would be placed on the moorings.

It will be seen from the foregoing that the phosphate is shipped in bulk in its raw unground state. Various suggestions have been made in New Zealand recently to the effect that works should be established on the island for treating the material and shipping it in the form of either superphosphate or else finely ground raw phosphate. The argument commonly used in favour of the proposal is that labour is cheaper on the island than it is in New Zealand. While this is true, there are good reasons why the present system should be continued. As regards superphosphate-works, a small island in the middle of the ocean, without a harbour and where many difficulties are encountered which naturally do not pertain to the mainland, is about the last place to select for the erection and running of what would necessarily need to be elaborate and extensive works. At the present time a good deal of material has to be landed at the island, and it is found by experience that practically as much labour is involved in landing 1 ton as in shipping about 10 tons of phosphate. Superphosphate-works would entail the landing of large quantities of sulphur and other material, besides employing many more men under conditions which are necessarily more expensive than on the mainland. The same objections apply to some extent to the proposal to grind finely the phosphate on the island so that it may be ready for use on arrival at New Zealand. A further drawback to the proposal is that phosphate in that condition would have to be shipped in bags, otherwise most of it would blow away during the operation of shipping. Experience has shown that it is very much slower to ship phosphate in bags than in bulk, owing to the peculiar conditions prevailing on the island, and therefore it is inadvisable to change the phosphate from a condition in which it is easy to handle to the reverse condition.

The principal factor in delivering cheap phosphate must of necessity be the steamer freight, and in order to secure the lowest possible rates all arrangements must be made at the island with the view of giving the quickest possible despatch to the vessels. Quick shipping is there-

fore the crux of the situation, and nothing must be allowed to come in its way. While a shortage of fertilizer-works in New Zealand has been in the past, and still is, a serious drawback, it is gradually being overcome, and it is hoped that in the near future works at the various centres will be capable of dealing with all the raw phosphate brought

QUARRYING PHOSPHATE IN FIRST-CLASS COUNTRY, OCEAN ISLAND.

into the Dominion. Fertilizer-works should therefore be situated at seaports close to farming centres, in order to avoid coastal freights and to minimize railway freights, but only at such seaports as can take vessels with a carrying-capacity of not less than 4,000 tons.

The plant at the two islands calls for some description. All the machinery is electrically driven, current being generated by powerful

Diesel engines. The fitting-shops are complete and serviceable ; casting is done, and the 15 horse-power oil-engines used in the launches are made on the island. There is a complete condensing plant capable of supplying the inhabitants with fresh water in the event of a drought, and a very serviceable refrigerating plant. The jetties are steel cantilever structures, projecting out beyond the edge of the reef in order that the lighters may be loaded outside the surf, which is sometimes very high. There are powerful wireless installations at each island, under the control of the authorities, the Nauru plant having been erected by the Germans. It is found that " wireless ", is of the greatest service in connection with the phosphate operations.

A white staff of about sixty-five is employed on each island, the various departments (not necessarily in order of importance) being the medical, marine, civil engineering, mechanical and electrical engineering, accountancy, storekeeping, and analytical. Many of the staff have their wives and families with them, and everything possible in reason is done for their comfort. The element of recreation is well to the fore ; there are tennis-courts (sometimes lit by electricity for night playing), billiard-tables, cinema-shows, &c. Not the least is the talent among the staff, and many visitors to both islands have been surprised and pleased at the concerts and entertainments. An open-air theatre is used for the purpose ; the performers have a suitable stage, while the white audience sits outside. The Natives and others are usually allowed to attend, and altogether it forms a picturesque scene.

The labour force on each island ranges from seven hundred to one thousand. As far as possible, Kanakas from the neighbouring groups are used, but there are not enough available, and the deficiency is made up with Chinese, who have proved very suitable for the land work, while the Kanakas excel at the boat work. The conditions under which these labourers are employed are pronounced excellent by competent authorities. The local Government representative naturally keeps in close touch with everything pertaining to their welfare, and when the men's term of service expires quite frequently many of them sign on for a further term. The Chinese are, of course, kept away from the Native villages, and their general behaviour is very good. The Nauru Natives have recently been encouraged by the Administrator to work at the phosphate, and this should have an important bearing on their future. Throughout the Pacific it has been found that where a Native community does an ordinary amount of work its numbers do not decrease, and sometimes increase. When the Natives are content to live on what a bountiful Nature supplies, practically without doing any work, they die out.

### OCEAN ISLAND.

Ocean Island, or Paanopa, an incorrect rendering of the native name Banaba, was discovered by the ship " Ocean " in the year 1804. It is about six miles in circumference, and roughly oval in shape, somewhat resembling an oyster-shell—in fact, among some of the London business men who quite approved of the dividends derived therefrom it was commonly called " the oyster." The island when first sighted from the sea looks like a green mound ; the height of the central tableland is about 265 ft., and from this it slopes more or less gradually to the coast, which in most places consists of rough coral

limestone cliffs from 10 ft. to 25 ft. high. In Home Bay there is a very useful stretch of sandy beach, which has always been a favourite place with the Natives for launching their canoes. In various parts of the island terraces are plainly discernible, indicating the stages at which it has been raised to its present height.

As with Nauru, very little has been written about Ocean Island prior to the starting of phosphate operations. The earliest account we have is a chapter in an interesting book by the late John Webster, "The Last Cruise of the Wanderer." This vessel was an armed yacht owned by Ben Boyd, formerly Lord Mayor of London, who seems to have had some visionary ideas about founding settlements in the Pacific. He called at Ocean Island in 1851, and Mr. Webster graphically describes the visit. An interesting relic of the cruise is to be seen at Albert Park, Auckland, in the shape of a brass cannon of French manufacture,

STEEL CANTILEVER JETTIES AND PHOSPHATE-BINS AT OCEAN ISLAND.

which was the long-tom on the yacht, and is said to have originally been captured at Waterloo. From Mr. Webster's account it appears that there were then about two thousand Natives on the island, and judging from the remains of old villages still to be seen there must have been some such number. Later on the island became a favourite calling-place for whaling-vessels in search of fresh provisions, and, unfortunately, disease was taken ashore, which greatly reduced the population, while numbers left at any opportunity that offered for lands where life was not so rigorous. In 1900, when operations were started on the phosphate deposits, one of the first concerns of the company was to take in hand the existing disease among the Natives, with most successful results. At the present time they number a little over four hundred, and appear to be holding their own. The island was evidently peopled from the Gilbert Group, about 250 miles to the eastward, where the Natives are of a similar type and talk the same language. In that latitude the equatorial current runs very strongly

to the westward, and many canoes have been swept away from the Gilberts, in which case they had a chance of bringing up at Ocean Island, or Nauru, where there are still some descendants of Gilbert-Islanders.

About thirty years ago a Native teacher was landed on the island by the American Board of Foreign Missions, and before long most of the inhabitants had embraced Christianity. When the writer went there in 1900 there were still a good many "begans" (pagans), but the behaviour of the whole community was quite changed from their previous thievish reputation, and they were remarkably honest. The Native teacher who was then there, Taremon (Solomon) by name, remained on the island for many years before returning to his own island in the Gilbert Group, and by his faithful work and consistent life was much respected by all.

ENGINEERING-SHOP AT OCEAN ISLAND.

The Natives are a brown-skinned, straight-haired race, not so heavily built perhaps as the Nauruans, but strong and active. Their island contains comparatively few coconut-trees, and has been subject to very severe droughts, when no vegetable food was available. They were then thrown back on the sea for their food-supplies, and in all probability are about the most skilful fishermen in the Pacific. The element of sport does not come into their minds, and one of the many things they cannot understand about the white man is that he goes out fishing when not requiring fish for food.

During severe drought-times the Natives were hard put to it for supplies of drinking-water. There are no wells, as at Nauru, and it was the duty of the women every morning to visit caves in the interior, with torches and baskets of coconut-shells. Little pools of water are found here and there in the caves, from which the coconut-shells were filled, but during drought they gradually dry up. The Natives say

that at such times they often used to go out catching flying-fish, just for the sake of the moisture contained in the aqueous humour of their eyes, which are particularly large. Naturally, fear of droughts was always present in their minds, and, when they were first told that the company would bring labourers from other places to work the phosphate, one old chief promptly asked, "What will they drink?" The modern Ocean-Islander with his cistern or tanks is well off for water ordinarily, and during drought-times can, of course, obtain supplies from the condensers

A great change has come over the circumstances of the Natives since phosphate operations were started in 1900. They were then probably the poorest Native community in the Pacific—so poor that there was not even a "beach-comber" living among them; the prolonged droughts had frightened them away. They are now quite well-to-do, and it may be mentioned that during the war they contributed £1,000 in a lump sum towards the Prince of Wales's Relief Fund.

Ocean Island had not been considered of sufficient importance for any of the Powers to occupy it, but in view of its new-found wealth, combined with the urgent representations of the directors of the Pacific Phosphate Company, the Imperial Government decided to do so, and on 28th September, 1901, H.M.S. "Pylades," under the command of Captain (now Admiral) Tupper, called, and the flag was hoisted with all due ceremony.

Regarding the total quantity of phosphate on Ocean Island, as previously explained, one can make only approximate estimates. Probably 30,000,000 tons are available, but this quantity, like the figures mentioned for Nauru, may be much exceeded. The deposits exist over the whole island; the houses are built on phosphate; the roads consist of the same material, and the railway-lines are ballasted with it. The best deposit is on the central tableland, where it is of phenomenal quality and depth. Cargoes taken from there run from 87 to 88 per cent. tribasic phosphate of lime, and a depth of 40 ft. to 50 ft. is not unusual. The material is run down from the tableland by self-acting tram-lines to the driers and bins situated close to the inner end of the jetties. The main storage-bin has a capacity of 50,000 tons. In other ways the process of handling the phosphate is much the same as at Nauru.

The acquisition of Ocean Island by the three countries, in addition to Nauru, will be an important factor in the future, as the two islands work well together. In ordinary fine weather Nauru is the better place for quick shipping, but the opposite is the case under adverse westerly weather conditions, when Home Bay, at Ocean Island, proves a very valuable asset in getting vessels loaded and away. The plant at Ocean Island is quite an elaborate one, and up to 210,000 tons have been shipped in one year, a figure which Nauru has not as yet reached.

It is interesting to look back to the time when the first shipments took place, and when an incident happened which demonstrated the truth of the saying, "Bad beginnings make good endings." The first jetty, a wooden structure, had just been finished, also a tram-line leading down to it at a steep grade. The time had come to test the work, and the result was somewhat anxiously watched by a small knot of whites, also by a large crowd of Ocean-Islanders, who had collected from all parts to see the wonderful things that the white man

was going to do. The first truck, loaded with 2 tons of phosphate in bags, was started off for the jetty; it took the down grade with unexpected momentum, went with its contents like a streak along the jetty and right over the end into deep water. The feelings of the white men can be imagined, but it was a joyous episode for the Ocean-Islanders and other Native labourers. They have a keen sense of humour, and many of them fairly rolled about the ground in their mirth. Any readers who may be discouraged over a bad start when they have something big on hand may be cheered up on reflecting how the first truck-load of phosphate left Ocean Island.

WORKED-OUT PHOSPHATE-FIELD AT OCEAN ISLAND, SHOWING THE CORAL PINNACLES LEFT BARE.

The labourers employed on Ocean Island are mostly Kanakas from the Gilbert and Ellice Groups, and the fact that they have been the main labour force since 1900 demonstrates their suitability for the work, also the popularity of the employment with them. Many of their islands are exposed surf-bound places similar to Ocean Island, and on these the Natives are accustomed to the roughest surf conditions from childhood. This fits them in every way for the boat work at Ocean Island, and it would be a difficult matter to replace them. As at Nauru, the insufficiency of Kanakas is made up with Chinese, and the two classes of labour prove quite satisfactory. Some apprehension appears to exist in New Zealand as to the treatment and behaviour of the labourers, particularly of the Asiatics. In this connection the

following extract from an article by Mr. A. H. Mahaffy in *Blackwood's Magazine*, of November, 1910, may be quoted as being a testimony from an independent authority. Mr. Mahaffy says: "The now considerable population of the island, consisting of so many different elements, lives in wonderful harmony and peace. Crime is almost unknown, and during the six months in which I had the honour to represent the arm of the law as Resident Commissioner one solitary Court case came before me. It was the theft by a Japanese of some stores. Disturbances among the Native population or the indentured labourers are of extremely rare occurrence, and I gladly bear testimony to the very great humanity and kindness with which the officers of the company treat the mixed Native population."

The maintenance of good health on both Nauru and Ocean Islands has naturally been a matter requiring close attention, and some of the measures adopted are quite up to date. For instance, the settlements have complete systems of water-borne sewerage. Electrically driven pumps deliver large quantities of sea-water to a high elevation — at Ocean Island about 250 ft.—and this flushes the sewers. The hospitals there are on the hill, and are quite up to date. A resident medical officer is stationed at each island, assisted by a dispenser and trained nurse, who acts as matron, with Native orderlies under her control.

### CONCLUSION.

It will be seen that New Zealand possesses a most valuable asset in her part-interest in Nauru and Ocean Islands, and no apprehension need be felt regarding adequate phosphate-supplies for many years to come. Not only is the quantity enormous, but the quality is of the highest grade known, a most important factor in the fertilizer trade. Another important feature is that the islands are within comparatively easy reach of New Zealand, Ocean Island being about 2,250 miles from Auckland. This means that the steamer freights should not be unduly high, while on the islands everything is being done to produce the phosphate at low cost. Everything points to the fact that as the years roll on the phosphate deposits of Nauru and Ocean Islands will play an important part in the welfare not only of the farmer, but of the Dominion in general.

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*Invercargill Prison Farm.*—The annual report of the Prisons Department for 1919–20 states that the farm connected with the borstal institution has made steady progress, and now the whole area is ring-fenced and subdivided into grazing-areas. There were last season approximately 800 acres under grass, 40 acres in oat crops for chaff, and 40 acres in turnips for winter feed, and it was estimated to have a hay crop from 150 to 200 tons, the farm carrying 320 store stock and 92 milking-cows. An up-to-date piggery has been erected, allowing for the convenient handling of ninety pigs for fattening purposes. It will be recalled that the initial operations on the area comprising this farm were described in an article entitled "Estuary Reclamation at Invercargill: Remarkable Agricultural Conversion," published in the *Journal* for April, 1918.

# THE CATTLE-TICK AND ITS CONTROL.*

A. R. YOUNG, M.R.C.V.S., Director of the Live-stock Division

In New Zealand the cattle-tick (variety *Haemaphysalis bispinosa*) was first observed in the North Auckland district, where the mode of its introduction is obscure. This locality being extremely favourable for its development it readily increased, with the result that it has now spread over a large area. A line drawn from the Manukau to Mercury Bay would leave the part to the north as what may be described as tick-infested country. From there southward to a line from Kawhia to Opotiki would indicate where the ticks have been found in very isolated cases. Within the past few years the spread of the pest has been very marked, and the risk existed that unless checked it would overrun the whole of the North Island. It is satisfactory, however, to note that the settlers in the infested districts have shown a keen desire for its suppression, and have organized themselves into administrative committees with this object in view, their efforts in this direction being well supported by the stockowners of clean districts. This organized co-operation is a valuable aid to the Department in administering the regulations now in force.

Only brief remarks on the life-history of the cattle-tick need here be given.† Upon observing an infected animal a much larger number of male than female ticks will be found. The reason for this is simply that once the male gets upon the animal he is in no hurry to leave his congenial feeding-ground; but the female, immediately she becomes fertile, proceeds to engorge herself as fast as possible, and whenever this is completed she drops off upon the ground and seeks some quiet, sheltered spot where she may deposit her eggs. After resting a few days in the spot selected she proceeds to lay the large number of from one thousand to three thousand eggs; she then dies. The eggs as deposited are resistant to climatic conditions, so that they are not easily destroyed by adverse circumstances, although these would delay the hatching, which may take place within a fortnight or extend over two or three months, according to conditions. The ticks hatched are known as "seed-ticks." They are capable of lying dormant in adverse circumstances, but become extremely active whenever the weather is favourable. They can also live for some time without any food whatever. In order to secure its existence, however, the seed-tick must sooner or later become attached to a suitable host, which in this case is cattle. The tick would have considerable difficulty in reaching cattle if it depended entirely upon crawling across the ground and over the feet and up the legs, as the animal in walking about would be continually brushing the tick off its feet. To wait until it got an animal in the

* These notes are part of a lecture recently given to the Farmers' Union, New Plymouth, with the addition of plans and matters relating thereto.

† Further information on the subject will be found in an article "Notes regarding Ticks found on Farm-animals in New Zealand," by Dr. C. J. Reakes, published in the *Journal* for February, 1918.

recumbent position would also be to reduce the tick's favourable chances for access to its host. It therefore adopts the very ingenious method of climbing upon the blades of tall grass or on any roughage which may take it to a height where it can grip on to the legs of any animal (including man) which may happen to pass by. Being of a very active nature, the ticks soon get from the legs to the body of cattle, and in a short time mating takes place, with the results already described.

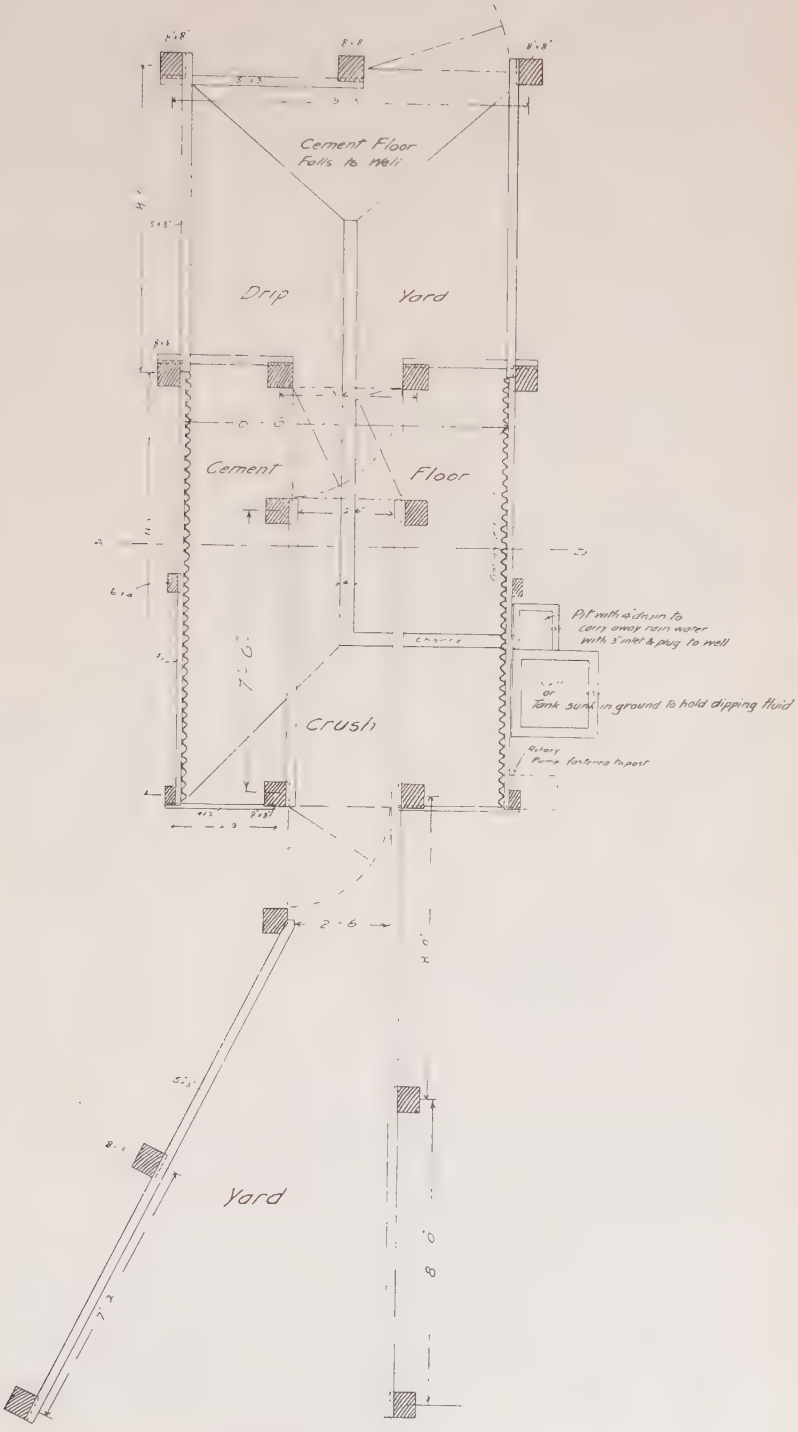
Having regard to the fact that the seed-tick attaches itself to other farm-animals besides cattle, it has been often suggested that all such animals should have been included in the control regulations under the Stock Act. When it is realized, however, that seed-ticks may attach themselves to man, dogs, hares, rabbits, and even the feathered tribe—though all are really unsuitable hosts—it will be seen that to have included these would have been to lay down something which could not be enforced, even if an Inspector were placed on every farm. At the same time it is advisable that horses and dogs in the infested districts should be examined by the owners and, if found infected, given a dip along with the cattle. Another suggestion has been that a quarantine boundary-line should have been drawn; but as this was considered to be useless under the conditions already described, the regulations were so framed that any place where ticks were found automatically became an infected area. It will thus be seen that the boundary is made elastic, and that no formalities are required for extending boundaries if or when the tick finds its way into new fields. Another point is that although ticks may be disseminated by animals other than cattle they must be thus spread in considerable numbers before it is certain that they will ultimately become attached to cattle and breed. In the meantime, therefore, dependence is being placed upon the chief precautions which have already been taken, and it is strongly recommended, having regard to the habit of the seed-tick in infested places to climb upon the rough herbage, that all gullies and rough places should be periodically fired if possible. This would eliminate large numbers of seed-ticks, and possibly eggs, for the shorter the pasturage is kept the less chance is there for the tick to get attached to cattle, and if it fails in this it will, of course, die.

There is another tick which may be confounded with the cattle-tick, one which infests poultry and also wild feathered creatures. It is recommended that any one finding ticks of any description (excluding, of course, the so-called sheep-tick) in his locality should forward specimens to the Live-stock Division for identification.

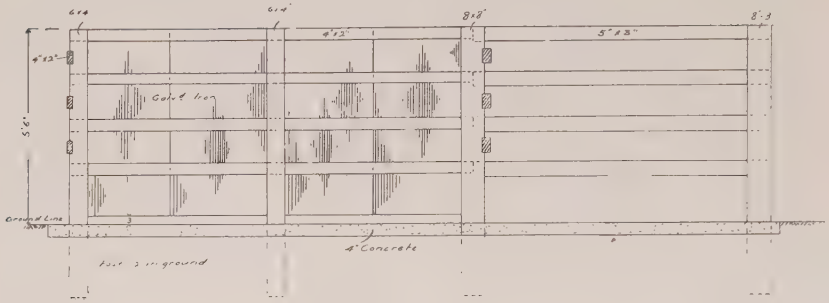
The methods (in order of merit) adopted to eradicate or prevent the spread of the cattle-tick are dipping, spraying, and hand-dressing. Dipping is recognized as by far the most efficient method, for by this means unhandled animals can be treated just as rapidly as a docile cow. In the United States of America a tick of similar habits though of a different variety from *Haemaphysalis bispinosa* has been eradicated over very large areas by the dipping treatment. Several cattle-dips have already been constructed in North Auckland, and but for the extreme shortage of cement many more would have been in existence. More rapid work is now proceeding, and it is hoped that within a short time sufficient dips will be provided to meet all requirements. Where public dips are constructed, if the Department approves of the locality

CATTLE-DIP.

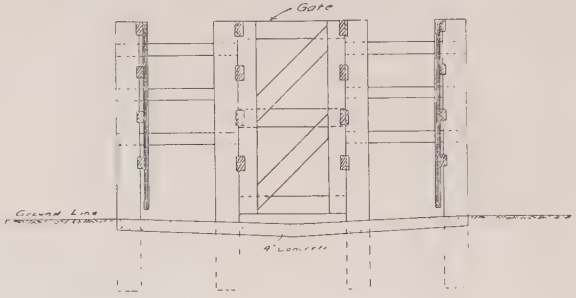
*(Plans by Public Works Department.)*




CATTLE SPRAY-CRUSH.

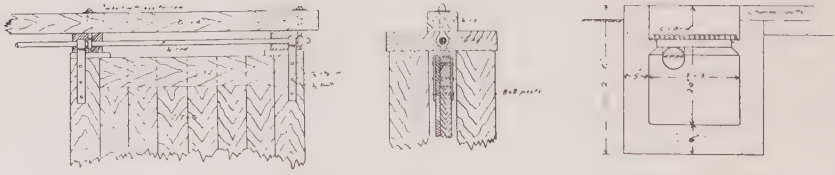



— SIDE ELEVATION —




— SECTIONAL ELEVATION at A-B —

DETAILS OF SPRAY-CRUSH



TOP OF SLIDING GATE. SECTION OF DRAINAGE WELL.

FURTHER DETAILS OF DIP.

and structure, the Government subsidizes the cost, on a pound-for-pound basis up to a limit of £150 per dip, as its share. The Government is prepared to subsidize up to forty public dips, and further provision will be made if necessary.

The Department has had plans prepared of a good standard type of cattle-dip, embodying all the latest known improvements; also plans of a spray-crush, for use where that method, which is suitable with quieter beasts such as dairy cattle, is adopted. These plans are here reproduced on a small scale for general information. Full-sized working plans, together with complete specifications, are available on application to the Live-stock Division by parties actually undertaking the construction of dips or crushes. The Auckland officers of the Division

are specially equipped for giving full information and advice on all matters concerning the cattle-tick and its control.

As regards cattle-dip preparations, stockowners should see that they obtain a reliable brand. Great care is necessary in mixing small quantities of dip for spraying, cases having occurred recently in which cattle have been injured by scalding due to the preparation having been used considerably over strength. Farmers are advised to apply grease or oil to the teats of dairy cows before these animals are dipped or sprayed, in order to prevent irritation of those parts.

The cattle-tick regulations were framed and gazetted last year to assist the farmer in eradicating the pest and to protect clean districts. A copy can be had on application to any Inspector of Stock.* The regulations prohibit the sale or movement of cattle harbouring ticks, and a perusal of them will show that great care has been taken to bring all possible avenues of spread into their scope. Two of the sections may be quoted with a view to showing some of the restrictions placed upon the movements of stock, as follows :—

> Every person who, by himself, his agent or servant, drives, without permission of the Inspector, any stock affected with cattle-ticks across or upon any land, or drives, depastures, or suffers to stray any such stock upon or along any highway, is liable to a fine not exceeding £50 and not less than £2 for every day during which such stock are so driven, depastured, or suffered to stray.
>
> No cattle shall be shipped from any port in the North Island unless they have been first examined by an Inspector and declared to be free from infestation by cattle-ticks.

Thus it will be observed that no cattle can be removed from any infected place—neither by road, railway, nor sea—until a clean certificate has been granted. It is also absolutely prohibited to expose for sale or exhibition any stock affected with cattle-ticks.

* The full text of the regulations was published in the *Journal* for October, 1919.

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*Laying Concrete in Water.*—When laying concrete in water it is necessary to check any flow of water round the concrete, use a richer mixture than would be used for outside work, and deposit with great care to avoid the cement being washed out. We do not know of any material that can safely be used to accelerate the setting of concrete under water.—*Public Works Department.*

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*Deer and Forestry.*—" In both the Rotorua and Tapanui districts," states the last annual report of the Forestry Department, " deer have become a serious nuisance in the plantations, and though forest officers are permitted to shoot them in the plantations it is both difficult and expensive to keep these pests in check. Dr. Sommerville has shown that in the Scottish Highlands deer have in many localities, by eating the seedlings, completely prevented the regeneration of Scots pine. These animals are likely to become a serious trouble in our own native forests as soon as management operations are started in them, and it will be necessary to take strict measures to control them."

# AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.

## IX. FURTHER DETAILS REGARDING THE EARNSCLEUGH (CENTRAL OTAGO) PALATABILITY EXPERIMENT.

DR. L. COCKAYNE, F.R.S., F.N.Z.Inst.

### GENERAL.

IN the October number of this *Journal* a general account was given of an experiment conducted on the Earnscleugh Experimental Area, near Clyde. Here, in order to bring out more fully the results of the experiment, an account of the behaviour of each species is given. Also, in some cases a comparison is made with the behaviour of a species during the previous Hanmer experiments; and, if sufficient facts are available, something is said as to its palatability as revealed up to the present by the general field observations. Thus, if the experiences of arid Central Otago confirm those of Hanmer—a much wetter locality—and the South Island sheep-runs generally, it seems clear that an accurate estimate of the relative palatability of the species in question may be considered well on the way to be established. On the other hand, where differences occur, more attention as to their palatability must evidently be paid to such species.

In a considerable number of cases the notes given below refer only to the Central Otago experiment. It must therefore be plainly understood that whatever is said as to the palatability of these species refers to the Earnscleugh (Central Otago) experiment, and to it alone; so no general applicability is claimed, but quite the contrary. But, as Central Otago and the adjacent dry area to the north present their own peculiar problems for solution, the evidence derived from the Earnscleugh experiment stands by itself as of special value.

It will be seen that the species are put into five classes. This classification, again, refers only to the results of the Earnscleugh experiment. It is certain that some of the species would have come into a different class had the experiment been conducted at a different season or in a locality with a wetter climate. Also, an attempt is made to arrange the species according to the degree of the palatability of each; but this, again, refers only to the Earnscleugh experiment, while such arrangement is quite tentative.

### NOTES REGARDING THE PALATABILITY OF EACH SPECIES.

#### CLASS I. SPECIES OF HIGH PALATABILITY.

*Cocksfoot (Dactylis glomerata).*—There were two classes of cocksfoot in the pasture—namely, young growth about three months old resulting from cutting part of the sown area for hay, and tall tussocks of hard stems with more or less green leaves near their base. These cocksfoot tussocks, some of which had been grown from seed sown some seven or eight years before, were extremely vigorous, notwithstanding that they

were situated on a steep extremely dry hillside, where there had been virtually no rain for more than four months. Nor had they been grazed, except by a few rabbits, or cut during the period of their existence.

As soon as the sheep were let into the enclosure they commenced eating the young growth of the plants which had been mown earlier in the season, and this they continued doing day by day, until by the end of the eleventh day virtually all was eaten to the ground. The only other competing plant at the commencement of the experiment which was freely eaten in the presence of leaves of cocksfoot four months old was lucerne of the same age. It is hard to say which of the two was preferred; if anything, perhaps cocksfoot takes first place. The young cocksfoot of the sown area also came into competition with old uncut cocksfoot tussocks. These, in its presence, were untouched. This was also the case with old lucerne, though the leaves of such were occasionally eaten

More interesting than the continuous grazing of comparatively young cocksfoot, especially as concerns Central Otago, is the fact of the high palatability of old plants in seed. These were eaten readily as soon as the sheep spread from the mown plants on to the uncultivated slopes. Throughout the grazing-period, except during the first few days, cocksfoot tussocks were being regularly eaten, the greener leaves first and then the dry leaves and stems. Figs. 2 and 4 of the preceding article (October, 1920) show clearly enough that if the experiment had been carried out for a few days longer *all* the cocksfoot, even the driest stalks, would have been eaten to the ground.

The conditions under which these uncut old plants were growing must be understood in order that the value of cocksfoot as a pasture-plant for Central Otago may be fully estimated. The slope where the greater part grew was extremely steep; the roots of the plant were about 2 ft. long, and the soil at much less than that depth was apparently extremely dry. Judging, for instance, from an examination of the soil of the Clyde Hospital grounds at a depth of 2 ft. and upwards, the amount of moisture in the Earnscleugh soil at a depth of 2 ft. can hardly have exceeded 4 per cent.

As for the relative palatability of dry cocksfoot, it certainly stood far higher than any of the species here put under the head of "medium palatability." Its palatability-value as compared with that of dry lucerne and catsear is dealt with below.

Long before the experiment was concluded, notwithstanding the dryness of the ground, some of the earlier-eaten plants had put forth new leaves more than 1 in. in length. It is certainly of importance to have learnt that dry, coarse, large cocksfoot tussocks, believed by many to be of but little value for feed, were readily eaten, and that close feeding apparently did no harm; and also that cocksfoot grows luxuriantly under the most arid conditions which New Zealand can offer. It now remains to discover the cheapest methods of establishing this splendid grass on the depleted hillsides. Will surface-sowing alone suffice, or must methods of getting the seed more or less covered by soil, &c., be used—*e.g.*, harrowing, or trampling by sheep? The experiments of the Department of Agriculture, on the Dunstan Mountain, now well in hand, ought before long to give some definite answers to these questions.

*Lucerne (Medicago sativa).*—Much that has been already said about cocksfoot applies to lucerne. There was both growth about three

months old and uncut plants 2 ft. to 3 ft. high which had been established from seed for about eight years. Also abundance of hard, dry stems, left behind after the lucerne-cocksfoot hay had been taken away, lay upon the ground. The young lucerne, as already explained, together with the young cocksfoot, was eaten at once. As for the old plants, the leaves were eaten first of all and the stems left standing. But by the eleventh day the upper parts of the stems had been eaten, while the lower parts were still affording food. The dry stalks lying on the ground were also eaten freely (see Fig. 1). Some days before the sheep were removed virtually all the tall lucerne was eaten to the ground; indeed, many of the plants were so closely cropped that it looked as if they would not recover. But this was not so; some were putting forth new growth in the presence of the sheep, and, so far as I can judge, not one plant has been killed through the heavy grazing.

Before leaving this matter of the lucerne it must be pointed out that the plants of the experimental area had been established by rather shallow cultivation—*i.e.*, they had not been dealt with on the principles of dry-farming—and that they had grown vigorously for about eight years without any water other than what they got by means of their deep rooting and from the occasional rain. Certainly the behaviour of this most valuable pasture-plant demands that it should be tried in experimental seed-mixtures for depleted ground.

*Red Clover (Trifolium pratense).*—There was not a great deal of red clover on the Earnscleugh area, while all there was occurred on the sown ground. On the first day of the experiment the seed-pods were freely eaten by such sheep as had wandered from the lucerne-cocksfoot. By the eighth day all the red clover had been eaten.

Owing to the small quantity of this plant it was not possible to truly estimate its relative palatability, but it was probably quite equal to that of the uncut lucerne. On several occasions it was eaten in the presence of cocksfoot; and, at first, yarrow was not eaten in its presence.

*Alsike (Trifolium hybridum).*—There was very little of this species. It was not eaten at all until the second day, when the seed-pods were completely demolished. By the eighth day the stems and leaves were all eaten and fresh growth was appearing. The species evidently is greatly relished. Though established on the Earnscleugh area as early as any of the species it has not increased through natural sowing.

*Sheep's Burnet (Poterium Sanguisorba).*—There was a good deal of this plant here and there in the sown ground, as well as abundance in its original rows, also a certain amount had established itself on the lower slopes of the hillside. The leaves were eaten more or less on the first day of the experiment. On the eleventh day the lower part of the stalks still remained uneaten.

*Catsear* (Hypochoeris radicata).*—As numerous field observations have shown that catsear is one of the very first plants eaten by sheep grazing naturally throughout the South Island runs it was of special interest to note its behaviour during the Earnscleugh experiment. It was extremely abundant on the driest, most sunny slopes, where it had

* Catsear is distinguished from dandelion (*Taraxacum officinale*) by its bristly (not smooth, hairless) leaves, branched solid (not unbranched, hollow) flower-stalks, and smaller flower-heads than those of the dandelion. By many it is known as "capeweed."

## EARNSCLEUGH PALATABILITY EXPERIMENT.

FIG. 1. SHEEP EATING THICK DRY STALKS OF LUCERNE ON THE EXPERIMENTAL AREA

FIG. 2. VERY DRY MEADOW-GRASS (POA PRATENSIS) EATEN TO THE GROUND IN THE PRESENCE OF DRY COCKSFOOT.

[*W. D. Reid, photos.*

naturally occupied not merely the depleted ground—that portion most difficult of all to recolonize—but had also gained the sown area, and was likewise in great quantity in the small enclosure.* From the foregoing it can be seen that catsear came into competition with a large majority of the pasture-plants.

At the time of the experiment the catsear-plants looked at their worst so far as palatability was concerned. The rosettes of leaves, smaller and less succulent than when growing in a wetter climate, were more or less burnt up, but there was an abundance of dry flower-stalks and seed-heads (see Fig. 1 in article viii of this series). All the same, the species was eaten constantly throughout the experiment, until not merely none remained, but in places where it had been thickest hardly a trace was to be seen, even the roots themselves being demolished.

As for the actual palatability-value of catsear, it is not easy to define its status. Certainly it does not come far from being equal to cocksfoot in general, and quite the equal of old cocksfoot in the coarse tussock state. In the small enclosure, though a certain amount of cocksfoot was there also, catsear was the first plant to be eaten. So, too, on the hillside it was frequently observed to be eaten in the presence of cocksfoot, and at times in the presence of old lucerne. On the sown ground at the end of the first week it had been grazed on to a considerable extent, but a large amount still remained.

*Yarrow (Achillaea Millefolium).*—The behaviour of yarrow stands by itself in the Earnscleugh experiment. What its actual palatability-value is I am not in a position to state. It was not until the fourth day of the experiment that yarrow was attacked; but once eaten the plant was not let alone until all was demolished, and even the underground stems laid bare and partly eaten. By the end of the ninth day all the yarrow in the pasture had been disposed of, except the green leaves and the young growth. Green yarrow, in fact, is apparently much less palatable than that which has been dried up, the green leaves having been severely let alone until the dry parts of the plant were consumed. How palatable yarrow becomes for sheep as soon as they commence feeding upon it is shown by the fact that on the first day it was eaten the following highly palatable species, *it being present*, were neglected: Cocksfoot, catsear, sheep's burnet, and lucerne.

How far yarrow is a nutritious food I do not know for certain. Its aromatic character has earned for it the reputation of being valuable medicinally, and so of special use in pastures. Be this as it may, it is the value of the plant as a *food* which concerns this article. The most suggestive information on this head is with regard to a North American species, *Achillaea lanulosa*.† This plant, blue foxglove‡ (*Penstemon procerus*), and sweet sage (*Artemisia discolor*) are the leading

* Those who have read the former article dealing with this experiment may remember that three-fifths of an acre, called "the small enclosure," was fenced off from the rest of the area.

† See A. W. Sampson, "Plant Succession in relation to Range Management," U.S. Dept. Agric., Bull. No. 791, Washington, 1919.

‡ This must not be confused with the foxglove (*Digitalis purpurea*), one of the noxious weeds of New Zealand. Popular names of plants are frequently, as in this case, most misleading, for a valuable plant, judged by its popular name alone, might easily be looked upon as dangerous in a pasture; while, *vice versa*, a most harmful plant, bearing the same name as one well known to be beneficent, might readily be warmly welcomed.

plants in the second stage of deterioration of the primitive pasture of the highlands of Utah. Now, according to Sampson (*l.c.*, p. 70), sheep make rapid gains on the "foxglove-sweet-sage-yarrow" pasture "early in the season when the herbage is succulent and tender." He also states that the palatability for sheep of the yarrow is high, and that of the two other dominant plants is medium, while of the total florula of twenty-seven species only five others are of high palatability. Thus it seems that this American species of *Achillaea* is not merely palatable, but possesses considerable fattening-qualities.

*Birdsfoot Trefoil (Lotus corniculatus).*—There was very little of this in the pasture, but one large plant was especially conspicuous. This was slightly eaten on the second day of the experiment, and by the eleventh day all the leaves and young growth were gone, but apparently the stems have a much lower palatability.

*Chicory (Cichorium Intybus).*—The sheep commenced eating the chicory, of which there was a good deal in some parts of the sown ground, on the fifth day of the experiment. The leaves alone were eaten. By the eleventh day there remained only the dry stalks and a small amount of young growth.

*Sainfoin (Onobrychis viciaefolia).*—There was very little sainfoin. It was eaten to some extent on the second day of the experiment, and by the eleventh day it was stripped of leaves, but the stems were uneaten.

*Sowthistle (Sonchus oleraceus).*—This was not abundant, but what there was had come spontaneously. By the eleventh day both stems and leaves had been closely eaten.

*Woodrush (Luzula campestris* var.*).*—*Luzula campestris* is a species found in all temperate regions of the earth, but it consists of many distinct varieties, some of which are confined to New Zealand. These varieties are difficult to distinguish; indeed, the group is but little known as yet. What concerns this article is that the plant of the Earnscleugh area is of high palatability, for, wherever it occurred, it was early eaten to the ground. As different forms of the species grow naturally in all the tussock pastures, it is evident that more should be learned about them from the economic standpoint.

### CLASS 2. SPECIES OF MEDIUM PALATABILITY.

*Rib-grass* (Plantago lanceolata).*—There was but little of this plant, though it might well have been expected to have spread considerably. I have no record of when it was first attacked, but by the eleventh day the leaves had been closely eaten, while flower-stalks and seed-heads remained untouched.

*Meadow-grass (Poa pratensis).*—Hardly any green leaves remained in the patches of this grass; it was burnt up to the last degree. Notwithstanding its apparently unpalatable condition it was eaten to the ground by the seventeenth day. In one place where it had been greatly eaten dry cocksfoot still remained uneaten (see Fig. 2), and, in another place, dry Yorkshire fog.

Although here meadow-grass is classified as a plant of medium palatability, this only refers to the plant when dried up. The first experiment at Hanmer showed that, *in the presence of cocksfoot*, it was completely eaten before the cocksfoot was touched, although when

* "Rib-grass" is not a grass. Ribwort, another of its names, would be more suitable and not misleading.

meadow-grass was absent cocksfoot took first place among all the other species. The field observations constantly record that meadow-grass is eaten first of all. If one sees sheep grazing on the ordinary tussock pasture, in a large majority of cases it is either meadow-grass or catsear which is being eaten.

*Yorkshire Fog (Holcus lanatus).*—There were both fairly green plants and those with stout dried-up stems and withered leaves. Green plants were eaten at times from about the fourth day, and before the close of the experiment such were disposed of; but although the dry plants were eaten to a limited extent many of these were untouched when the sheep were removed. The results, so far as green plants go, show a slighter degree of palatability than has been shown for this species when grazed by sheep in the open.

*Chewings Fescue (Festuca rubra* var.*).*—There was a good deal of this grass, both more or less pure or mixed with red fescue, or dotted about among other plants. It was sparingly eaten on the fifth day, and from that time onwards, when the more palatable plants in the vicinity had been eaten to the ground, the Chewings fescue received a good deal of attention until the conclusion of the experiment.

It is highly interesting to have procured some definite information regarding this grass. In the first article of this series I wrote (this *Journal*, January, 1919, p. 5): "Two sheep-farmers, both men of the greatest experience, expressed to me totally divergent views as to the value of Chewings fescue, the one asserting that sheep hardly touch it, and the other that it was a valuable feed." It is satisfactory, then, to know that in Central Otago, after some months' drought, this grass was eaten to a considerable extent by sheep which were far from being hungry. The point has been reached, in fact, for further observations, and a knowledge of its true value for mountain sheep-runs should not be difficult to ascertain.

*Hooked Sedge (Uncinia* sp.*).*—Long before the conclusion of the experiment such plants as were present both on the sown area and the slopes were eaten to the ground. My notes do not tell the date of the commencement of the eating. Various species of *Uncinia*—all indigenous New Zealand plants—are more or less common in montane tussock-grassland, and their behaviour needs careful watching.

*Thick-stemmed Broom (Carmichaelia Petriei).*—Possibly this species should come in the next class; but the plants were fairly tall shrubs, which could be reached only by sheep standing on their hind legs. There were only a few plants, and these competed chiefly with the three indigenous tussock grasses. That this broom is put into Class 2 rather than into Class 3 is owing to its being much more difficult of access to the sheep than is blue-grass, for instance. All the New Zealand brooms which occur in the sheep-pastures are palatable, but they do not generally occur in sufficient quantity to be of much moment. Where exposed to the full attack of both sheep and rabbits the thick-stemmed broom is eaten to the ground, and frequently killed outright, but where sheep and rabbits are excluded a damaged plant soon regains its full size.

*Tall Fescue (Festuca gigantea).*—There was only a little of this species. Before the close of the experiment it was eaten to the ground. Its exact position with regard to palatability I cannot state. Although a bad weed in moist ground in the North Island, it may prove a valuable grass for the depleted areas.

EARNSCLEUGH PALATABILITY EXPERIMENT.

FIG. 3. BLUE-GRASS TUSSOCK WHICH HAD BEEN FREELY EATEN IN THE PRESENCE OF TALL BLUE-TUSSOCK THAT HAD BEEN HARDLY TOUCHED (THE LATTER NOT SHOWN IN PHOTO).

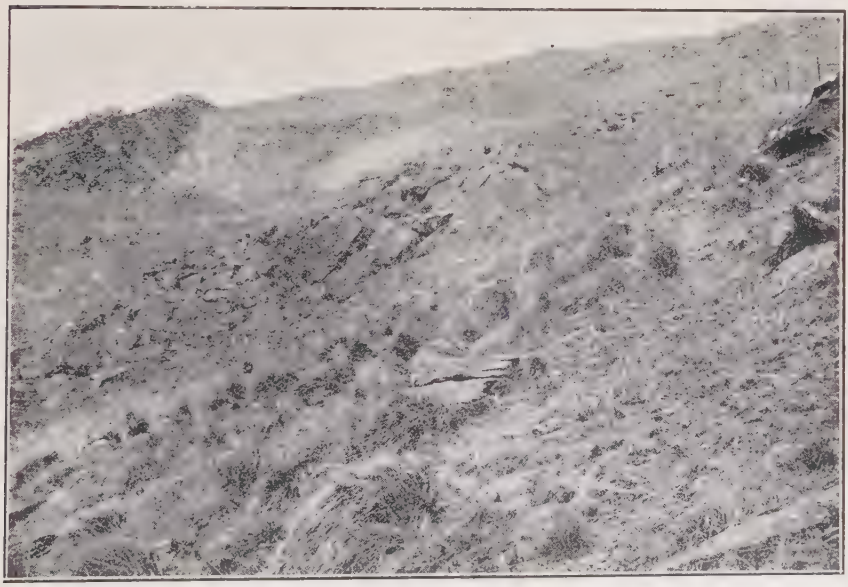

FIG. 4. PORTION OF THE SMALL ENCLOSURE, SHOWING THE ABUNDANCE OF BLUE-GRASS AND TALL BLUE-TUSSOCK REMAINING AFTER THE HEAVY STOCKING TO WHICH THIS AREA WAS EXPOSED

[*W. D. Reid, photos.*

*Carex Colensoi.*—This little sedge—for which no popular name has yet been coined—was eaten closely, but I have no exact details.

CLASS 3. SPECIES OF LOW PALATABILITY.

*Sorrel (Rumex Acetosella).*—The position of sorrel in the results of the Earnscleugh experiment is certainly not its true place, its palatability in general being far higher. There was not a great deal of sorrel in the pasture. The sheep commenced eating it early, but throughout the experiment it was not greatly eaten, though it was easy to overlook plants in this regard.

*Small Vetch (Vicia* sp.*).*—The small amount of this plant present was extremely dry. By the eighth day it had not been eaten to any extent, but by the eighteenth day it had been greatly eaten.

*Blue-grass (Agropyron scabrum).*—There are many forms of blue-grass, even in the neighbourhood of Clyde. A form with narrow leaves is abundant on the Earnscleugh area. The blue-grass grew under these three conditions with regard to competing plants: (1) On the cultivated ground, it having come there spontaneously; (2) on the sunny slopes, where it was dotted here and there; and (3) on the dark faces of the gullies, where it came chiefly into competition with tall blue-tussock and, to a lesser extent, with fescue-tussock. In situation (1) for a long time the blue-grass was untouched, as it came into competition with most of the plants of Class 1 (high palatability). For instance, on the nineteenth day the tussocks of blue-grass were generally only slightly eaten, but all the accompanying plants were gone. From that time onwards, however, these tussocks were freely eaten, and many were cropped close to the ground (see Fig. 3) by the time the sheep were removed. In situation (2) blue-grass was cropped earlier than in situation (1), but rarely was a tussock more than partially eaten. Even at the close of the experiment many of the tussocks still offered abundant feed. In situation (3) the blue-grass was more closely cropped than elsewhere.

To sum up, the experiment has clearly shown that blue-grass, though not of anything like the same degree of palatability as the plants of Class 1, is nevertheless readily eaten by well-fed sheep when in competition only with such grasses as are usual in tussock-grassland, and that an increase in the amount of blue-grass in the montane tussock-grassland generally would greatly improve the pasture.

*Red Fescue (Festuca rubra* var.*).*—Red fescue was one of the species which were originally sown on the cultivated ground both in rows and as a constituent of certain mixtures. It was also in more or less abundance on the uncultivated slopes, where it either established itself spontaneously or had come from seed sown broadcast. It forms tussocks after the manner of the indigenous fescue-tussock, but smaller.

Compared with its relative, Chewings fescue, it is of considerably lower palatability. At the conclusion of the experiment a good deal of red fescue remained with the tall dry stems usually untouched. It was especially eaten where it formed a pure pasture. On the final day of the experiment a considerable number of readily accessible plants were not eaten at all.

Compared with blue-grass, red fescue, according to this experiment, appears to be somewhat less palatable, but the evidence procured was conflicting.

*Barley-grass (Hordeum murinum).*—This was only in small quantity. The sole note I have regarding this grass was taken on the nineteenth day; it says, "*Hordeum murinum* eaten to the ground."

In late winter, when young, barley-grass is quite an important food of the depleted country, especially in gullies.

*Tall Blue-tussock (Poa intermedia).*—This indigenous grass showed considerably lower palatability than blue-grass. Nevertheless, long before the blue-grass in its vicinity was eaten to the ground blue-tussock was eaten more or less, and occasionally closely. Young plants, or youngish leaves after burning, possess a much higher palatability. In the small enclosure, notwithstanding the heavy stocking, much of this grass remained untouched at the conclusion of the experiment (Fig. 4).

At the present time tall blue-tussock is the dominant grass of the dry portion of Central Otago above 2,500 ft. altitude. It is therefore of considerable interest to have learnt something definite regarding its palatability.

*Sweet Vernal (Anthoxanthum odoratum).*—There was a fair amount of sweet vernal, mostly with dried-up leaves and stems. Where there were green leaves these were eaten to some small extent. In general the plant was hardly touched.

In spring, when tender, as the second Hanmer experiment showed, sweet vernal under heavy grazing is eaten to the ground and possesses a much higher palatability than blue-tussock (*Poa Colensoi*), a very near relative of tall blue-tussock.

*Winged Thistle (Carduus pycnocephalus).*—There were only the dry, hard stems of this plant remaining. In the small enclosure these were more or less eaten after some time.

*Smooth-leaved Mullein (Verbascum Blattaria).*—This was eaten slightly from the seventh day of the experiment, but, generally speaking, the amount eaten was almost negligible. This result is at variance with certain field observations made at Hanmer and near Lindis Pass.

*White Clover (Trifolium repens).*—There was very little white clover. It was apparently only eaten to a small extent, but I have no definite notes on this matter.

The question of the palatability of white clover for sheep requires special investigation. Up to the present the evidence is mostly against its being other than a plant of low palatability.

*Perennial Rye-grass (Lolium perenne).*—This grass was only in limited quantity and greatly burnt up. Of course, in ordinary pasture in a wetter climate it would have come in Class 1. By the thirteenth day the few green leaves had been slightly eaten, but at the end of the experiment the dry leaves were still untouched. Evidently dried-up rye-grass is not nearly the equal for palatability of dried-up meadow-grass.

*Odorous Tree-daisy (Olearia odorata).*—This shrub was eaten to some small extent. It is usually not in sufficient quantity to be of any moment.

*Hawksbeard (Crepis capillaris).*—This species, which field observations have suggested was of high palatability, was eaten only to a limited extent, and then mainly the seed-heads. Catsear, in its presence, was eaten freely.

*Fescue-tussock (Festuca novae-zelandiae).*—There was not nearly as much of this—the dominant tussock of South Island montane grass-land—as of blue-grass or tall blue-tussock. But besides the plants

which, together with the two last-named grasses, had come spontaneously on the dark faces of the gullies there was one row which had been raised from seed. This was still intact at the conclusion of the experiment (see Fig. 3, p. 181, this *Journal*, October, 1920). Also, elsewhere, except with quite young plants, fescue-tussock was hardly touched.

This experiment, then, confirms the experience of the two former experiments and of many field observations, that fescue-tussock, except when young, or its young leaves after burning, is worthless as food for sheep.

*Tall Oat-grass (Arrhenatherum elatius).*—Even the young leaves after cutting were hardly eaten. The dry stalks were altogether neglected, and the small amount of leaves at the base of the plant was eaten to an extremely limited extent. It will be of great interest to see how this easily grown plant behaves during grazing in spring.

*Canary-grass (Phalaris bulbosa* and *P. commutata).*—These may be classed with tall oat-grass.

*Red-top (Agrostis vulgaris).*—At the close of the experiment this remained much as at the beginning.

*Tree-lupin (Lupinus arboreus).*—There was very little of this species. Beyond being nibbled slightly it was let alone.

### CLASS 4. SPECIES OF NO PALATABILITY.

The following is a list of the species which apparently were not eaten at all: Hair-grass (*Aira caryophyllea*); soft brome-grass (*Bromus hordeaceus*); sterile brome-grass (*B. sterilis*); annual fescue (*Festuca myuros*); harestail-grass (*Lagurus ovatus*); desert-poa (*Poa maniototo*); nodding club-rush (*Scirpus cernuus*); the various kinds of piripiri (*Acaena*); spaniard (*Aciphylla Colensoi*); scarlet pimpernel (*Anagallis arvensis*); alpine hard-fern (*Blechnum penna marina*); larger mouse-ear (*Cerastium triviale*); common lip-fern (*Cheilanthes Sieberi*); the three willow-herbs (*Epilobium*); white fireweed (*Erechtites quadridentata*); New Zealand bedstraw (*Galium umbrosum*); short-flowered cranesbill (*Geranium sessiliflorum* var. *glabrum*); spotted burr-clover (*Medicago maculata*); forget-me-not (*Myosotis*); yellow oxalis (*Oxalis corniculata*); hard shield-fern (*Polystichum Richardi*); the scabweed and its allies (*Raoulia*); curled dock (*Rumex crispus*); black nightshade (*Solanum nigrum*); mountain-chickweed (*Stellaria gracilenta*); mountain-nettle (*Urtica aspera*); common coprosma (*Coprosma propinqua*).

The following species, some of which field observations have proved to be more or less palatable, do not appear in my notes. They must be kept distinct from the species of the previous paragraph: Plume-grass (*Dichelachne crinita*); annual poa (*Poa annua*); hemlock-storksbill or wild geranium (*Erodium Cicutarium*); horehound (*Marrumbium vulgare*); wild-irishman (*Discaria toumatou*); *Hymenanthera dentata* var. *alpina*;* gooseberry (*Ribes Grossularia*); sweetbrier (*Rosa Eglanteria*); narrow-leaved lawyer (*Rubus subpauperatus*).

* In the October number of this *Journal*, in the list of species of the Earnscleugh Area, p. 188, through a printer's error, the following appears: "*Hymenanthera dentata* var. *Alpina lupinus arboreus*," with the popular name "Tree-lupin." For the sake of the general reader unversed in botanical technique it may be pointed out that there are two plants—the one, as correctly cited in the text above and which has no popular name, and the other, *Lupinus arboreus*, the tree-lupin.

# INSECTS INHABITING THE GUM FLUID OF PHORMIUM.

DAVID MILLER, Entomologist, Biology Section.

LIVING in the gum fluid secreted by and collected in the leaf-bases of the native flax (*Phormium tenax*) are large numbers of insect larvæ which belong to three species of flies—*Lepidomyia decessum*, *Syrphus ropalus*, and a midge of the family *Chironomyidae*. Owing to the prevalence of these larvæ in the gum fluid of the flax suffering from "yellow-leaf" disease it was thought that they might be responsible in some way for the discoloration of the leaf. However, an examination of flax both attacked by and free from yellow-leaf shows that these larvæ are of universal occurrence, and are to be found swarming in the gum fluid of any flax-bush; further, that the gum fluid is the natural breeding habitat of these insects, which are all common native species.

The two flies *Lepidomyia decessum* and *Syrphus ropalus* belong to the family *Syrphidae* (hover-flies), which from an economic standpoint is a most important group, the larvæ of many species being responsible for the destruction of innumerable insect pests, such as aphides and caterpillars.* The larvæ of *L. decessum* (Fig. 1), which feed upon the gum fluid, are large and conspicuous, though many very small young ones may be found at the same time. They are of the "rat-tailed" type, so called on account of the telescopic tail-like breathing-siphon which projects from the end of the body, and is thrust through the surface of the gum fluid to come into contact with the atmosphere. The young larvæ are pearly white, but the older ones are somewhat darker; on the under-side of the body are several swellings which act as means of locomotion. Apparently the larval life is of considerable length, since specimens of large larvæ were kept under observation from April to October before they pupated. Larvæ in all stages of development occur throughout the year. When the larvæ have reached their full size (about ½ in.) they crawl out of the gum fluid on to the dead leaves of the flax-bush, and transform to pear-shaped pupæ covered by a greyish-white powder from the dried gum fluid (Fig. 2). After a time the shining blue-black adult (Fig. 3) emerges through a circular opening at the broad end of the pupæ.†

The larvæ (Fig. 4) of *Syrphus ropalus* are predaceous, and feed upon the small midge larvæ, and to a less extent the larvæ of *Lepidomyia decessum*. It is rather interesting to note that this hover-fly does not breed only in the gum fluid of flax, but the larvæ crawl over the leaves in search of the flax-grub (*Xanthorhoe praefectata*).‡ They are also found

* For a fuller account of the hover-flies in New Zealand see the writer's article "The Economic Bearing of Hover-flies," p. 129, vol. 17, of this *Journal*.

† Mr. G. V. Hudson has found the larvæ of this fly breeding in decaying matter beneath the bark of cabbage-trees (*Cordyline australis*); his specimens emerged in November, but I have observed and bred the adults from September to March and even April.

‡ See "Control of New Zealand Flax-grubs by Means of Parasites," D. Miller, this *Journal*, vol. xv, p. 303

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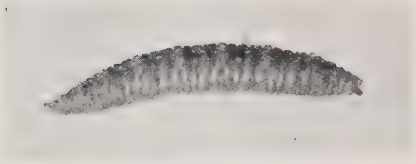
LEPIDOMYIA DECESSUM.

Fig. 1. Larva. Fig. 2. Pupa, side view. Fig. 2a. Pupa, from above.
Fig. 3. Adult female. All × 4



4

5

6

SYRPHUS ROPALUS.

Fig. 4. Larva. Fig. 5. Pupa. Fig. 6. Adult male. All × 4.

sheltering during the day between the leaves of cabbage-trees (*Cordyline australis*), emerging after nightfall to devour the grubs of the cabbage-tree moth (*Venusia verriculata*).* The pupæ (Fig. 5) of *S. ropalus*, when the larvæ breed in the gum fluid of flax, are to be found attached to some sheltered part of the dead leaves. They are club-shaped, and light brown in colour with darker-coloured stripes; the adult insect (Fig. 6) measures about $\frac{3}{8}$ in. in length, and is brightly coloured with orange-yellow bands and spots upon a black background.

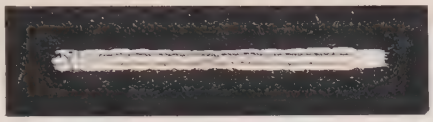


FIG. 7. LARVA OF CHIRONOMID MIDGE. × 10.

The third species breeding in the flax-gum fluid is the chironomid midge. The larvæ (Fig. 7), which occur in swarms, are small (about $\frac{1}{6}$ in. long), pearl-white in colour, and worm-like in form, swimming slowly with repeated loopings of the body. When ready to transform to pupæ the larvæ attach themselves to the leaf-butts, where they are kept continually moist. The pupæ are minute and silver-white, the legs and wings of the adult being easily seen if slightly magnified. The midge itself is minute and perfectly black, with densely plumose feelers, which give a feathery appearance to the head.

* An account of the habits of this fly upon cabbage-trees will be found in "Contributions to the Economical and Biological Study of New Zealand Entomology," by D. Miller and M. N. Watt, Trans. N.Z. Inst., vol. 47, p. 278.

[Drawings by D. Miller; photos by E. B. Levy.]

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## SAMPLES OF MILK FOR EXAMINATION.

It is found that samples of milk sent to the Veterinary Laboratory, Wallaceville, for examination in cases of suspected mammitis, &c., frequently arrive without any label or mark of identification on the bottles. Besides a covering letter, the bottle or package should always be marked in such a way that it may be readily identified, and the result of the examination communicated to the sender with certainty.

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"*Silver-fish.*"—These insects, when infesting houses, may be trapped and destroyed by covering pieces of cardboard with paste made of flour to which some white arsenic has been added. Another method is to fumigate the infested room with sulphur.

# TESTING OF PUREBRED DAIRY COWS.

## C.O.R. LIST TO END OF NOVEMBER.

W. M. SINGLETON, Assistant Director of the Dairy Division.

THE list of certificates issued during November is comparatively strong for some classes, although other classes show no records of exceptional merit. The mature Jerseys are again very much in evidence with quite a number of praiseworthy records. The Friesians have added another name to the 800 lb. class, and the Ayrshires have a new leader of the two-year-olds. The Milking Shorthorns are very creditably represented in the mature class, and show a good record in the junior four-year-olds. Owing to pedigrees of these particular animals not being available in the Herd-book no comment on their breeding can be made.

### JERSEYS.

The records printed in the appended list show that Messrs. O'Sullivan and Sons are again to the fore with animals in the junior two-year-old and three-year-old classes respectively. Meadowvale Ovation and Meadowvale Desire are daughters of Sunflower's Perseus from different dams. Meadowvale Desire is from Oaklea's Maid, a daughter of Dalesman Jack from a daughter of K.C.B. Oaklea's Maid as a two-year-old produced a credit of 375·73 lb. butterfat. Just what percentage of the daughter's superiority over her dam is due to the influence of Sunflower's Perseus we are unable to state.

The four-year-old Jerseys contain two good records in those for Salamonia and Poi. Mr. Hazelton, of Waihou, the owner of Salamonia, has done good work for Jerseys in the Thames Valley. Salamonia is a granddaughter, through her sire, of Campanile's Sultan, her sire being a half-brother to Sultan's Daisy. Salamonia's dam traces to K.C.B. and at least four times to the Primrose strain.

Poi, owned and tested by Mr. F. S. McRae, belongs to a well-known strain. Her dam is Mere, who held the world's championship with a record for heifers commencing test under two years of age. Mere is a granddaughter of Charm, with a 572-lb.-butterfat record as a four-year-old. Readers will recollect that Mere is a daughter of Fancy's Lord Twylish, a sire with fourteen C.O.R. daughters, three of which exceeded 600 lb. butterfat. The sire of Poi is Buttercup's Titan, by Titan from a daughter of Retford Boy. Titan is full brother to Titanite, who has a C.O.R. for 513·88 lb. butterfat. This second record of Poi's raises her previous record in the junior two-year-old class by almost 90 lb. fat.

To the mature class are credited five records of more than 600 lb. butterfat, and seven others of more than 500 lb. Lambert's Countess, owned by Mr. J. Hale, holds pride of place with one of only two records exceeding the 650 lb. mark. She is sired by a son of Campanile's Sultan, and is from Countess of St. Lambert. Majesty's Neathead, tested by Mr. S. R. Lancaster, also exceeded the 650 lb. production. She is sired by Majesty's Fox, who now has twenty-seven C.O.R. daughters. The dam of Majesty's Neathead is Neathead, with a C.O.R. in the

three-year-old class for 565·75 lb. fat. As a show-ring cow Neathead combined beauty and production to a degree much above the average.

### FRIESIANS.

Numerically the black-and-whites do not constitute a strong representation this month. Their average production, however, is high. Four of the five trace exclusively to North American strains. The sire and dam of Heilo Johanna Lyons were imported from the United States. Her sire is Mutual Piebe of Rock, who has now eight C.O.R. daughters. Mutual Piebe of Rock is by Mutual Piebe de Kol, well known as the sire of Mutual Pearl of Rock, Dominion Mutual Mercedes of Rock, and other C.O.R. cows.

Mr. Vernon Marx, of Mangatoki, has not appeared in C.O.R. lists hitherto, but he has certainly permitted Alcartra Clothilde Pietje

ALCARTRA CLOTHILDE PIETJE.

(here depicted) to make an enviable record. This record is all the more creditable in that shortly after this cow commenced her test she developed udder trouble, and produced the major portion of her season's yield while milking from three quarters only. She traces entirely to strains imported by Mr. Newton King. Her sire and dam are each sired by King Alcartra Pietje, whose pedigree includes such animals as Pietje XXII, Hengerveld de Kol, and Alcartra Polkadot. Sir de Kol Inka Pietertje, who also figures twice in the pedigree, has some fourteen C.O.R. daughters, including Lady Rozine, with a C.O.R. for 510·93 lb. butterfat.

Messrs. H. North and Sons have two representatives in this list. The first is Burkeyje Beets Posch, a Canadian-bred half-sister of Burkeyje Sylvia Posch, New Zealand's highest record cow at present. These two females have in common some 87 per cent. of their ancestry,

as indicated by their pedigrees. It was therefore to be expected that Burkeyje Beets Posch would produce well. Holland Lassie, owned and tested by the same breeders, is a daughter of the well-known Cliffside Laddie, who now has eighteen C.O.R. daughters, a number of which have produced very attractive records. The dam of Holland Lassie is by King Manor de Kol and from a cow by Dutchman. She therefore receives three-fourths of her inheritance from strains imported from North America.

### AYRSHIRES.

We are pleased to report the records of three Ayrshires. Greenfield's Sprightly II, owned and tested by Mr. C. E. C. Webb, of Koputaroa, has annexed a very creditable record in the senior two-year-old class. She becomes the leader of her class, displacing Kanadale Linda, who has a C.O.R. for 502·55 lb. butterfat. This new class-leader makes a good addition to the Ayrshire records, and her performance should prove an encouragement to other young Ayrshire breeders. The dam of Greenfield's Sprightly II is from Dark Stately of Greenfields, C.O.R. 354·29 lb. butterfat in 344 days as a four-year-old. This cow is by Brown Jock, who sired Bonnie Stately, C.O.R. 357·15 lb. fat in 311 days. The sire of Sprightly II's dam is a son of Prince John of Inglewood, and is therefore half-brother to Daisy II of Hagbourne, who in 325 days produced a C.O.R. credit of 467·12 lb. fat. As these milking-periods are all for less than a year the days in milk include to a considerable extent the period of drying off. Due allowance should be made in this respect. We congratulate Mr. Webb on his success with his favourite breed.

### LIST OF RECORDS COMPLETED IN NOVEMBER, 1920.

| Name of Cow and Class. | Tested by | Age at starting Test. | Fat req'd. for Cert. | Yield for Season. | | |
|---|---|---|---|---|---|---|
| | | | | Days. | Milk. | Fat. |
| | JERSEYS. | | | | | |
| *Junior Two-year-old.* | | Yrs.dys. | lb. | | lb. | lb. |
| Meadowvale Ovation | E. O'Sullivan and Sons, Tariki | 2 16 | 242·1 | 361 | 8,139·5 | 486·55 |
| Lady's Sweet .. | A. J. Harris, Bombay | 2 28 | 243·3 | 361 | 7,590·1 | 461·07 |
| Viola's Golden Mercedes | E. Griffiths, New Plymouth | 2 11 | 241·6 | 365 | 6,556·5 | 440·12 |
| Heroine's Pride .. | H. J. Berry, Kaupokonui | 1 318 | 240·5 | 354 | 7,053·6 | 415·91 |
| Briar Chase .. | W. J. Hall, Matatoki | 2 79 | 248·8 | 332 | 6,869·6 | 371·49 |
| Beauty's Sunbeam .. | F. E. Day, Tamahere | 2 34 | 243·9 | 365 | 7,496·4 | 363·21 |
| Snow View's Maid .. | D. P. F. Malone, Kaponga | 1 338 | 240·5 | 334 | 5,770·2 | 356·70 |
| Maria Louisa .. | F. J. B. Ryburn, Paterangi | 1 341 | 240·5 | 365 | 7,080·4 | 352·17 |
| Sunshower .. | F. J. B. Ryburn, Paterangi | 2 56 | 246·1 | 331 | 6,196·7 | 350·80 |
| Beaumont's Miss Champ | R. Prentice, Kiwitea | 2 48 | 245·3 | 329 | 6,552·5 | 337·29 |
| Success of Bull's .. | F. J. Watson, Bull's | 2 65 | 247·0 | 357 | 5,743·3 | 297·06 |
| Lady Bilberry .. | E. Griffiths, New Plymouth | 2 52 | 245·7 | 323 | 5,639·0 | 294·65 |
| Belvedere Bilberry's Last | E. Griffiths, New Plymouth | 1 314 | 240·5 | 307 | 5,598·5 | 283·60 |

LIST OF RECORDS—*continued.*

| Name of Cow and Class. | Tested by | Age at starting Test. | Fat req'd. for Cert. | Yield for Season. | | |
|---|---|---|---|---|---|---|
| | | | | Days. | Milk. | Fat. |
| | JERSEYS—*continued.* | | | | | |
| *Senior Two-year-old.* | | Yrs. dys. | lb. | | lb. | lb. |
| Beachland's Marigold | F. J. B. Ryburn, Paterangi | 2 323 | 272·8 | 365 | 7,924·0 | 447·98 |
| Madam Matilda .. | A. Hazelton, Waihou | 2 296 | 270·1 | 365 | 7,080·8 | 404·23 |
| Hollybank Buttercup | E. Griffiths, New Plymouth | 2 313 | 271·8 | 319 | 7,622·9 | 401·47 |
| Waratah Tinsel .. | Mrs. M. A. Rogers, Katikati | 2 355 | 276·0 | 365 | 7,272·3 | 390·30 |
| *Three-year-old.* | | | | | | |
| Meadowvale Desire | E. O'Sullivan and Sons, Tariki | 3 7 | 277·7 | 365 | 9,411·3 | 570·31 |
| Tiny Kura .. | C. H. Weston, New Plymouth | 3 15 | 278·5 | 365 | 7,189·0 | 444·18 |
| Mountain View's Clematis | E. Griffiths, New Plymouth | 3 336 | 310·6 | 365 | 8,188·2 | 442·13 |
| Lady Winnie .. | E. Griffiths, New Plymouth | 3 356 | 312·6 | 365 | 6,440·1 | 412·79 |
| Heather Flower .. | J. Linn, Normanby .. | 3 351 | 312·1 | 262 | 6,624·6 | 405·63 |
| Waipuku Princess .. | A. Hazelton, Waihou | 3 37 | 280·7 | 365 | 7,372·7 | 394·29 |
| Heather Lady .. | A. L. Hooper, Mahoe | 3 353 | 312·3 | 328 | 6,362·7 | 353·80 |
| *Four-year-old.* | | | | | | |
| Salamonia .. | A. Hazelton, Waihou | 4 358 | 349·3 | 365 | 9,531·2 | 537·99 |
| Poi .. .. | F. S. McRae, Palmerston North | 4 82 | 321·7 | 340 | 9,942·1 | 528·85 |
| Roslyn Juno Light .. | J. Harris, Bombay .. | 4 345 | 348·0 | 365 | 8,759·4 | 493·56 |
| Mystery Lass .. | E. Griffiths, New Plymouth | 4 24 | 315·9 | 323 | 6,886·1 | 403·57 |
| *Mature.* | | | | | | |
| Lambert Countess .. | J. Hale, New Plymouth | 6 187 | 350·0 | 365 | 10,022·0 | 657·40 |
| Majesty's Neathead | S. R. Lancaster, Palmerston North | 6 320 | 350·0 | 365 | 10,667·75 | 650·54 |
| Jersey Bank Pretty | J. Hale, New Plymouth | 8 342 | 350·0 | 365 | 10,817·5 | 611·86 |
| Rainbow's Gleam .. | A. & J. O'Donnell, Inaha | 6 321 | 350·0 | 365 | 11,094·1 | 608.73 |
| Eminent's Caif .. | J. W. Bradey, Te Horo | 8 305 | 350·0 | 365 | 10,293·5 | 605·30 |
| Kathleen Twylish .. | F. E. Day, Tamahere | 7 307 | 350·0 | 365 | 9,960·8 | 591·04 |
| Rioter's Merry .. | J. Hale, New Plymouth | 6 10 | 350·0 | 365 | 10,409·5 | 586·63 |
| Rose Royal .. | J. Hale, New Plymouth | 7 81 | 350·0 | 362 | 10,977·0 | 548·07 |
| Miro Meadows Rata | C. A. Care, Cambridge | 6 222 | 350·0 | 365 | 9,285·3 | 531·29 |
| Olga's Butterman Chase | W. J. Hall, Matatoki | 7 10 | 350·0 | 343 | 8,796·5 | 515·54 |
| Fair Maid of Inaha | A. & J. O'Donnell, Inaha | 6 352 | 350·0 | 365 | 9,961·9 | 503·25 |
| Miss Neathead .. | S. R. Lancaster, Palmerston North | 6 267 | 350·0 | 356 | 7,269·75 | 500·85 |
| Wairoa .. .. | H. J. Berry, Kaupokonui | 9 252 | 350·0 | 356 | 7,742·2 | 467·53 |
| Roslyn Juno Girl .. | J. Harris, Bombay | 5 88 | 350·0 | 287 | 8,448·8 | 466·22 |
| Hazeline .. .. | W. J. Hall, Matatoki | 10 158 | 350·0 | 365 | 7,731·8 | 434·16 |
| Little Sultan's Mary | Murray Bros., Wharehuia | 7 189 | 350·0 | 317 | 6,484·0 | 422·54 |
| Queen Elizabeth .. | E. L. Roose, Pukekohe | 5 30 | 350·0 | 365 | 8,047·8 | 411·79 |
| Elvira .. .. | J. R. Jones, Tariki .. | 5 2 | 350·0 | 360 | 5,518·3 | 350·72 |
| | FRIESIANS. | | | | | |
| *Junior Two-year-old.* | | | | | | |
| Salma Hope De Kol | W. Barton, Featherston | 2 124 | 262·9 | 365 | 12,312·4 | 428·29 |
| *Senior Three-year-old.* | | | | | | |
| Heilo Johanna Lyons | W. Barton, Featherston | 3 299 | 306·9 | 365 | 14,896·7 | 529·60 |

LIST OF RECORDS—*continued.*

| Name of Cow and Class. | Tested by | Age at starting Test. | Fat req'd. for Cert. | Yield for Season. | | |
|---|---|---|---|---|---|---|
| | | | | Days. | Milk. | Fat. |
| | | FRIESIANS—*continued.* | | | | |
| *Mature.* | | Yrs. dys. | lb. | | lb. | lb. |
| Alcartra Clothilde Pietje | V. Marx, Mangatoki.. | 5 319 | 350·0 | 365 | 23,011·0 | 842·71 |
| Burkeyje Beets Posch | H. North and Sons, Omimi | 7 123 | 350·0 | 365 | 17,461·0 | 613·63 |
| Holland Lassie .. | H. North and Sons, Omimi | 7 272 | 350·0 | 365 | 16,172·1 | 576·47 |
| | | MILKING SHORTHORNS. | | | | |
| *Senior Two-year-old.* | | | | | | |
| Cloverlea Fairy I .. | D. Buick, Palmerston North | 2 350 | 275·5 | 339 | 9,497·2 | 378·91 |
| *Junior Three-year-old.* | | | | | | |
| Matangi Nancy .. | Ranstead Bros., Matangi | 3 9 | 277·9 | 365 | 10,795·4 | 399·63 |
| Rushmere Granny I | W. H. Brewster, Feilding | 3 43 | 281·3 | 365 | 8,938·9 | 345·40 |
| *Junior Four-year-old.* | | | | | | |
| Matangi Jewel .. | Ranstead Bros., Matangi | 4 6 | 314·1 | 365 | 12,524·4 | 509·45 |
| *Senior Four-year-old.* | | | | | | |
| Matangi Sunshine .. | Ranstead Bros., Matangi | 4 345 | 348·0 | 365 | 12,057·0 | 427·59 |
| *Mature.* | | | | | | |
| Newstead Bella .. | S. Lye, Newstead, Hamilton | .. | 350·0 | 365 | 15,274·0 | 594·62 |
| Newstead Pet .. | S. Lye, Newstead, Hamilton | .. | 350·0 | 365 | 14,345·2 | 551·50 |
| Willowbank Sunbeam | S. G. Morgan, Ngawapurua | 13 0 | 350·0 | 365 | 12·568·6 | 535·35 |
| Lowlands Beauty .. | C. Hearsey, Longburn | .. | 350·0 | 365 | 12,712·9 | 517·17 |
| Newstead Polly .. | S. Lye, Newstead, Hamilton | .. | 350·0 | 365 | 13,162·6 | 506·80 |
| Hamilton Mary .. | S. Lye, Newstead, Hamilton | .. | 350·0 | 364 | 13,102·7 | 500·14 |
| Matangi Anne .. | Ranstead Bros., Matangi | .. | 350·0 | 330 | 12,096·0 | 483·81 |
| Matangi Molly .. | Ranstead Brs., Matangi | 7 340 | 350·0 | 292 | 12,776·0 | 463·93 |
| Newstead Jenny .. | S. Lye, Newstead, Hamilton | .. | 350·0 | 357 | 10,645·8 | 452·75 |
| Newstead Nellie .. | S. Lye, Newstead, Hamilton | .. | 350·0 | 341 | 10,921·7 | 448·83 |
| Garnet of Cornwall Park | R. V. Brown, Weraroa | 12 31 | 350·0 | 320 | 11,384·7 | 419·59 |
| Newstead Pansy .. | S. Lye, Newstead, Hamilton | .. | 350·0 | 365 | 9,958·8 | 398·82 |
| | | AYRSHIRES. | | | | |
| *Two-year-old.* | | | | | | |
| Greenfield's Sprightly II | C. E. C. Webb, Koputaroa | 2 335 | 274·0 | 365 | 13,598·6 | 507·87 |
| *Three-year-old.* | | | | | | |
| Dominion Ruby II .. | A. Montgomerie, Kauwhata | 3 357 | 312·7 | 358 | 8,877·6 | 373·12 |
| Beauty I of Porirua | A. Montgomerie, Kauwhata | 3 304 | 307·4 | 323 | 9,000·4 | 347·50 |

# LEGISLATION OF 1920 AFFECTING RURAL INTERESTS.

T. D. H. HALL, Head Office, Department of Agriculture.

THE session of 1920 was not marked by any outstanding agricultural legislation, but the following summary sets out provisions which are of interest to the farming community :—

## RABBIT NUISANCE AMENDMENT ACT.

Part II of the Rabbit Nuisance Act, 1908, deals with the constitution of rabbit districts on the petition of the majority of stockowners therein. The qualification of a "stockowner" for this purpose is the ownership of 500 sheep or 100 head of cattle (one head of cattle is reckoned as five head of sheep), and these stockowners are the sole voters and ratepayers in any constituted district. Closer settlement and dairying have necessitated a change, and the stockowner's qualification is fixed by the Amendment Act at 100 sheep or 20 head of cattle.

Rabbit districts may also be constituted at the instance of ratepayers. The principal Act provides that in such districts the rate leviable for rabbit-destruction purposes shall be leviable on the rateable value of the land in the district. In certain classes of country this militates against the successful establishment or working of a district. Provision is therefore made for an alternative system of rating on an acreage basis. The rating-system to be adopted is to be determined by a poll.

Power is conferred on Rabbit Boards to borrow by way of overdraft on the security of the revenue receivable by them.

The Rabbit Nuisance Amendment Act, 1918, gave extended powers to Rabbit Boards, constituted under Part III of the principal Act, in the matter of the erection of rabbit-proof fencing. The rights and liabilities of the Boards as owners of the fences are now laid down by incorporating similar provisions to those already existing in the case of rabbit-proof-fencing districts.

The Governor-General in Council may authorize Rabbit Boards in districts constituted under Part II of the Rabbit Nuisance Act (stockowners) to take the necessary steps for destroying rabbits on land without first serving notice on the owners of the land.

Power is given to make regulations prescribing the means to be adopted for destroying rabbits, regulating trapping, regulating purchase and sale of rabbits and skins, and regulating the export of rabbits and skins.

## ORCHARD AND GARDEN DISEASES AMENDMENT ACT.

This amendment provides power to regulate the sale of fruit affected with black-spot.

APIARIES AMENDMENT ACT.

Power is given in this amendment to provide for a registration fee for apiaries. The revenue is to be devoted to the furtherance of the industry.

AGRICULTURAL AND PASTORAL SOCIETIES AMENDMENT ACT.

Before a society incorporated under the Agricultural and Pastoral Societies Act can sell or exchange any land derived by it from the Crown the precedent consent of the Governor-General in Council is now necessary.

COMPANIES AMENDMENT ACT.

When a company formed for a particular purpose desires to engage in operations not provided for in its memorandum or articles of association, a special procedure is necessary to amend the memorandum or articles. Relief is provided now in the case of companies formed wholly or in part for the manufacture of butter or cheese. Such companies may, without alteration in the memorandum or articles of association, engage in the manufacture of rennet, casein, sugar of milk, butter-boxes, cheese-crates, and other articles subsidiary to their main purpose, or may acquire shares in any company carrying out such manufactures, or formed to undertake the export and marketing of dairy-produce, or to erect and carry on cool stores and freezing-works.

LAND AND INCOME TAX AMENDMENT ACT.

The exemption from income-tax enjoyed by co-operative butter and cheese factories has been removed, but it is provided that in calculating the amount of income of such a factory there shall be deducted from the total receipts of the factories the amounts paid to suppliers in so far as such amounts are apportioned on the basis of the milk (or cream) supplied.

COUNTIES ACT.

County Councils are now given powers to erect cattle-dips, and to make by-laws and fix fees for their use.

County Councils are also empowered to purchase and sell rabbit-proof wire netting on suitable terms.

HEALTH ACT.

A local authority is empowered to make by-laws defining areas in its district within which it shall be unlawful to establish or maintain stables, cow-sheds, or piggeries. The Board of Health may direct such areas to be defined.

No cattle-saleyard may be established without the consent of the local authority and the Medical Officer of Health. Provision is made for the registration of cattle-saleyards, and no premises must be used as cattle-saleyards unless registered.

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*Board of Agriculture.*—Mr. James Begg, of Dunedin, has been appointed a member of the Board of Agriculture (Otago District), to fill the vacancy caused by the death of Mr. A. S. Orbell.

# THE USE OF NAURU ISLAND PHOSPHATE.

## EFFICACY OF THE FINELY GROUND RAW MATERIAL.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

It is not yet sufficiently realized by the farming community that the high-grade phosphates obtained from the Pacific islands have been for a number of years used on New Zealand soils without having been first converted into superphosphate. The only treatment to which the greater quantity of imported rock has been subjected before application to the soil is the purely mechanical process of drying, grinding to a powder, and diluting with other material. The use of ground phosphate rock by itself has passed beyond the experimental stage, as may be proved by the numerous field trials conducted with root crops at the Moumahaki Experimental Farm in past years, from 1904 onwards, and at the Mamaku Experimental Farm and the Wallaceville Laboratory Farm on pasture. It is true that for some classes of crops, notably those of the turnip family, an admixture of superphosphate with the phosphate rock, or even superphosphate by itself, may yield the highest results, as superphosphate contains a considerable quantity of a sulphur compound in the form of sulphate of lime, and compounds of sulphur are supposed to be beneficial to the turnip family, whereas phosphate rock contains no sulphur compounds. Further, applied in moderate amounts superphosphate is a powerful stimulant to the growth of root, hence to farm plants with an inferior rooting-system superphosphate affords a quick and efficient means of conveying an extremely soluble food to the young growing plant-roots.

It is a truism that unlike things cannot be compared. Superphosphate and phosphate rock are alike in that they supply phosphate to the land, but they are unlike in that each acts in a different manner, and therefore each is adapted for use in a different set of conditions. The phosphate in superphosphate is soluble in water, so that after being applied to the soil the phosphate is dissolved in the first rain, but it is quickly rendered insoluble in contact with the soil-particles, and is thus brought into intimate contact with the root-hairs and so absorbed. The phosphate in phosphate rock is insoluble in water, and therefore for bringing it into proximity with the root one must rely on the fineness of grinding. But even at this stage the conditions are not comparable. The phosphate of super after having become insoluble in pure water is still in a condition which is more soluble in the soil water—the latter containing the powerful solvent carbonic acid—than is the phosphate of phosphate rock. However, in a moist soil in a district of well-distributed rainfall this difference in solubility is not likely to result in so great a disparity of crop-yield as to affect the value of finely ground phosphate rock compared with superphosphate, and it must be remembered that there is more than twice as much phosphorus in the rock as in the super made from it. It is in dry, semi-arid and arid climates, where the

rainfall is ill-distributed and scanty, that superphosphate is so superior to phosphate rock. In districts like Southland, where the rainfall is well distributed and ample, guano (which is another somewhat euphemistic name for ground phosphate rock) is used in preference to superphosphate.

Too great stress cannot be laid on the fact that *bona fide* differences in the opinion of observers as to the relative efficacy of rock phosphate compared with superphosphate arise from differences in the soils and climates whence their experiences were derived. An Australian's experience is thus likely to differ largely from that of a New-Zealander. Similarly, experience derived from the arid portions of Central Otago or Marlborough is likely to provide a different judgment than that afforded by results derived from Southland, Taranaki, or Westland.

About 40,000 tons of phosphate rock were imported into New Zealand last year, only a comparatively small proportion of which could have been made into superphosphate, judging by the amount of sulphur imported into or mined in New Zealand. It is estimated that about 30,000 tons of this ground phosphate rock was used without any chemical treatment—that is to say, the only treatment used to convert the rock into a marketable phosphate was one of grinding and dilution with other materials. It is to be hoped that when Nauru phosphate arrives the amount of grinding it receives will be intensified in order to make a finer, more available product, and that the practice of dilution with sand and limestone may be abolished altogether. Where the farmer requires lime or limestone it is economically preferable to purchase it separately.

It is certainly incorrect to say that the phosphate rock when finely ground is unavailable for plants because it is insoluble in pure water, for the water in the soil is not pure water, but contains carbonic and other acids which are powerful agents in rendering mineral food available for the plant. It is also incorrect to say that phosphates are extensively leached out of the soil by the drainage-waters. The fate of the phosphates in the soil is one which is continually progressing towards a condition of greater insolubility. When the most soluble form of phosphate—super—is used the great proportion never percolates into the soil more than a few inches further by drainage, and therefore is comparatively stable in position until removed by crops or stock. To prevent a phosphate from becoming too insoluble, and therefore too unavailable for plants, it is advisable to lime freely and to keep the organic matter—the so-called humus—present in good quantities.

NOTES.—The Department's Bulletin No. 54 (New Series), "Rock Phosphate in New Zealand," obtainable free on application, gives details of the good results obtained from rock phosphate with crops. Articles on "The Improvement of Poor Pasture," in the *Journal* for January, 1919, and October, 1920, show the effect of top-dressing pasture with ground rock phosphate compared with other fertilizers.

Those who desire to study the matter further should consult the chapter "Use of Phosphorus in different Forms," in Hopkins's "Soil Fertility and Permanent Agriculture" (Ginn and Co., London, 1910); also Sir A. D. Hall's "Fertilizers and Manures," 1909, in which, on page 118, it is stated there is plenty of evidence that when mineral phosphates are really finely ground they are effective enough on soils retaining plenty of water. See also the recent statements of British authorities quoted on page 194 of the October number of this *Journal*.

# THE LATE SIR DAVID HUTCHINS.

By the death last month of Sir David Hutchins, the distinguished scientific forester, the *Journal* has lost an esteemed contributor. The first wide publicity given to Sir David's views on the forestry position in the Dominion was in our issues of October and November, 1916, when his address at the inaugural meeting of the Forestry League was published in revised form under the title of "Scientific National Forestry for New Zealand." This was subsequently reprinted by the League as a pamphlet. To the *Journal* for March, 1918, Sir David contributed an article on "The Waipoua Kauri Forest: Its Demarcation and Future

SIR DAVID HUTCHINS (ON RIGHT) AND MR. J. TROUNSON IN KAURI BUSH, NEAR KAIHU.

Management," a forerunner of his official report on the same subject. Several shorter notes by him on forestry subjects were also published at various dates.

It is unnecessary to here give biographical details of Sir David Hutchins's career and the circumstances of his coming to New Zealand, these having appeared elsewhere. A fitting public tribute to Sir David's work has also been paid by the president of the Forestry League, Sir James Wilson, to whom perhaps more than any other person Sir David's fortunate advent to this country was due. Suffice it to remark that at a critical stage for the future existence of the New Zealand native forests Sir David's forcible exposition and advocacy of demarcation and reservation combined with the production of a continuous yield of timber by natural regeneration and other improvement (in place

of destructive milling, which had come to be generally regarded as inevitable), was a leading factor towards saving the situation. It may also be fairly claimed that to his influence was mainly due the recent formation of a Dominion Department of Forestry, scientifically directed, and with the real foundation-work well in hand. Sir David's special work for the Dominion was thus really accomplished when he passed away.

Part I of a comprehensive report by Sir David Hutchins to the Government on "New Zealand Forestry," dealing with the kauri forests and forests of the North and forest management, was issued early in the present year. Sir David was very desirous that this treatise should have a good distribution among the farming community, being always keen to keep his gospel of forest reform before the leading rural interest. The publication, an illustrated volume of 200 pages, may be obtained by remitting 2s. 6d. to the Secretary, Forestry Department, Wellington.

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# WAIMATE WEST DEMONSTRATION AREA.

## OPERATIONS FOR YEAR 1919–20.

J. W. DEEM, Fields Instructor, and Supervisor of Subsidized Demonstration Farms.

THE Waimate West Demonstration Area is now fairly under way. From a financial point of view the first complete year has proved satisfactory, the working account showing a credit balance of £188 10s. 4d. The initial work outlined in the December, 1919, *Journal* has been continued. The manager's house has been completed, and a two-roomed cottage is in course of erection. This will be used as an office, and will provide sleeping-accommodation for extra labour on the farm.

### THE DAIRY HERD.

The results from the herd must be considered satisfactory. According to the testing association's figures the herd of thirty-one cows and sixteen heifers averaged 279·67 lb. butterfat per head for an average milking-period of 242 days, the cows averaging 296½ lb. and the heifers 252 lb. These figures work out at approximately 13,144 lb. butterfat for the season, whereas the actual amount credited at the factory was 13,019 lb., a difference of 125 lb. in favour of the association's figures. Against this 125 lb. has to be credited the fresh milk used for calves and the house. These points are mentioned to show that the results from the ordinary testing association are accurate enough for all practical purposes if properly carried out.

To emphasize the necessity of testing, it may be mentioned that the best cow gave 404 lb. and the poorest 216 lb. butterfat, while the best heifer gave 350 lb. and the poorest 178 lb. To further facilitate the testing of the herd while it is being milked with a releaser plant the shed has been fitted up with a Preston cow-detector plant for demonstration purposes.

Fourteen heifer calves were reared. Seven of these have been sold to the Stratford Model Dairy Farm Society, and seven are being retained to build up the herd.

### THE CROPS.

The crops on the whole were good. A great many varieties of roots, kales, &c., were tested.

*Roots.*—In the main varieties the best results were yielded in the following order :—

Mangolds: White Sugar, 60 tons 1 cwt.; Jersey Queen, 53 tons 18 cwt.; Prizewinner, 52 tons 13 cwt.; Long Red, 50 tons 1 cwt., per acre

Swedes: Grandmaster, 31 tons 6 cwt.; Superlative, 30 tons 17 cwt.; Best-of-All, 30 tons 7 cwt.; and Magnum Bonum, 29 tons 15 cwt., per acre. The swede-ground was very foul with weeds—fumitory and wild turnip—and it was found necessary to grow the crop in 28 in. drills, and give intercultivation. In a test for dry-rot Superlative was badly affected.

Soft turnips: Imperial Green Globe, 45 tons 17 cwt.; Purple-top Mammoth, 44 tons 15 cwt.; Lincolnshire Red Globe, 43 tons 5 cwt.; and Hardy Green Globe, 41 tons 6 cwt., per acre. Sown on the same day they were ready to feed in the following order: Purple-top Mammoth, Lincolnshire Red Globe, Imperial and Hardy Green Globe equal.

Carrots: Matchless White, 47 tons 16 cwt.; Magnum Bonum, 38 tons 10 cwt.; Sinclair's Champion, 34 tons 14 cwt., per acre.

*Millets and Sudan Grass.*—Six varieties of millets and one of Sudan grass were sown at the end of November, and, being very weedy, were cut on 19th January, at which time they were about 1 ft. high. They were cut again on 3rd March, and gave the following weighings per acre: Sudan grass, 13 tons 10 cwt.; Japanese millet, 12 tons; Hungarian millet, 11 tons 5 cwt.; Proso, 11 tons 1 cwt.; Manchurian, 10 tons 18 cwt.; Chinese, 7 tons 14 cwt.; Pearl, 5 tons 2 cwt. None of the millets made any further growth of value, but the Sudan grass came away rapidly and furnished a further cutting of between 4 and 5 tons per acre.

*Lucerne.*—It was found on breaking up the land that the whole of the farm was badly infested with weeds—wild turnip and fumitory being especially bad. This has delayed lucerne-sowing, but it is hoped to get an area down in the current December.

*Manurial Tests.*—With swedes, super and slag, equal parts; basic super; and super, bone, and slag, equal parts, gave the best results. In the mangold trials the addition of 3 cwt. of salt increased the yield by between 2 and 3 tons per acre. It was found in the trials that where bone-meal or blood-and-bone were the predominating manure the fly was very bad, many of the rows being cleaned right out, while adjoining rows with a mineral phosphatic manure were not touched.

### PASTURE TOP-DRESSING.

Sixty acres of the farm have now been top-dressed. It is too soon to record any definite results, although so far basic super seems to be doing as well as anything. One test, however, has already furnished interesting matter. In August, 1919, a 12-acre paddock was treated.

One half received 3 cwt. basic super per acre, the other half 6 cwt. carbonate of lime and 2 cwt. superphosphate per acre. In subsequent stocking last season the cows kept the basic super end closely fed down, and allowed the lime super end to get rank. During last winter the whole field was cleaned up, and this spring it has been more evenly fed down; at the same time the manager reports that the cows always eat the basic super end of the paddock first.

MANAGEMENT, ETC.

The committee whose personnel was given in last year's notes (*Journal*, December, 1919) and Mr. Dakers, the manager, are still in office, and all have pulled together to make the farm a success. The interest created has been evinced by the large number of visitors, including several branches of the Farmers' Union.

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# WORK FOR THE COMING MONTH.

## THE ORCHARD.

THE present two leading matters of interest among fruitgrowers, apart from ordinary routine work, are export and fire-blight. Whether considered separately or jointly, both these factors are calculated to have a very important bearing on the future of the fruit industry, and, although widely different from one point of view, if the worst should happen in either case the result will be very much the same.

Every one in the industry is aware that the local market must be relieved by some means, and, although there are different methods which, when jointly operating, may result satisfactorily, export suggests itself as being the most effective and simple means of attaining immediate and lasting results. Should failure, through any fault on the part of the grower, shipping companies, or markets, attend this phase of the industry, fruitgrowing in New Zealand is bound to receive a very definite set-back. Likewise, should fire-blight become generally spread throughout the fruitgrowing areas of the Dominion the effect on the industry would be quite as disastrous as the failure of export.

Fire-blight is firmly established in several large areas in the Auckland Province, but, fortunately, these areas in the main are of little importance from the viewpoint of existing commercial fruit-production. Whether the disease will spread to more important districts time alone will tell, and in the meantime the Department's officers are doing all that is within their power to lessen this danger. The Director-General of the Department, together with Messrs. T. W. Kirk and A. H. Cockayne, recently visited the affected areas for the purpose of studying the position first-hand with a view to formulating more effective statutory measures on the matter.

Adverting to export, the position is apparently well in hand to date. Preliminary bookings total well over 200,000 cases. Several districts are contributing, but the great bulk is coming from Nelson. Although there is still a lot of work to be done, the organization for assembling and handling the fruit in an efficient manner has been very much improved as compared with last year.

Although the possibility of failure with reference to both export and fire-blight has been referred to in this note, failure in either case is not necessarily anticipated. On the contrary, the object of such reference is more to impress the grower with the fact that all is not plain sailing, and that he, together with the Department, has a definite responsibility in both instances and must work in close co-operation, in order that success, not failure, may be the result.

—*J. A. Campbell, Assistant Director of the Horticulture Division.*

## AUCKLAND.

Weather conditions generally experienced during January being often conducive to the increase of fungoid diseases and insect pests, no relaxation in spraying operations should take place. The following are the most important:—Peach, nectarine, and plum: Commercial lime-sulphur, 1–125, or self-boiled lime-sulphur, 8–8–50, when the fruit begins to ripen, and further as circumstances demand. In cases where the black aphis of the peach is giving trouble McDougall's Insecticide, 1–50, should be used. A second application may also be necessary to effectually control this insect. Pear, apple, and quince: Commercial lime-sulphur, 33° test, 1–100, in conjunction with arsenate of lead, paste 1½ lb. or powder ¾ lb. to 50 gallons every twenty-one days. Lemon and orange: Bordeaux, 4–4–40, when petals have fallen from the main-crop blossoms (if not already applied). The commercial lime-sulphur application should be continued wherever black-spot is showing,

Cultivation should receive full attention throughout the month, especially if droughty conditions set in. —*J. W. Collard, Orchard Instructor, Auckland.*

## HAWKE'S BAY.

Crops on the average are light this season in this district, so the various varieties will need harvesting very carefully to secure the maximum returns. Early varieties of stone-fruits and apples will now claim attention. Peaches should be gathered while still firm, though of full size and well coloured. Make several pickings (selections) from the same trees, and pack separately all fruits inclined to a soft ripe condition. While there may be little or no brown-rot showing in the orchard, there is every chance that this trouble may develop under the congested conditions of a case pack. Endeavour to have the trees sprayed with lime-sulphur, 1–120, a week or so before picking; handle the fruit carefully; and, above all, do not pack skin-punctured fruits.

Though there will be plenty of other work on hand, make an effort to maintain a clean cultivation, with the surface soil well worked.

Spraying for the month will consist mainly of regular applications of arsenate of lead to apple, pear, quince, and plum, for codlin-moth, leech, and leaf-roller; lime-sulphur, 1–120, on stone-fruits, for rust and brown-rot; lime-sulphur, 1–100, on apples and pears, for red mite, powdery mildew, and black-spot; and Blackleaf 40 on apples affected with woolly aphis.

When preparing fruit for market the orchardist should remember to brand his cases with his registered number.

—*W. H. Rice, Orchard Instructor, Hastings.*

## NELSON.

Orchard summer spraying depends very much on the kinds and variety of fruit grown—on its susceptibility to aphis, spot, red mite, &c., and on the danger of burning or russeting the fruit. During these warmer months it is usual to further dilute the lime-sulphur spray to 1–120 for pip-fruit and 1–125 for stone-fruit. Brown-rot is often troublesome now, and the precautions recommended in last month's notes should be carefully observed. It should be remembered that bordeaux mixture and Blackleaf 40 when mixed together are dangerous to orchard foliage, the ingredients being incompatible.

While it is most undesirable to work the land too soon after rain or when it is the least bit sticky, if the weather be dry good cultivation should be maintained throughout January.

The stone-fruit harvest is now at its height. Greater care is needed in picking and packing these goods. Quite a different sample is required for local shops and factories as compared with Wellington and more distant markets. Too often these samples are somewhat mixed.

Towards the end of January it is customary to perform the operation of summer pruning where necessary. Its object is to check overrank growth and bring it into bearing. It is specially useful in the case of some varieties of pears.

The operation of budding can now be advantageously carried out.

—*W. C. Hyde, Orchard Instructor, Nelson.*

## CANTERBURY.

Insect pests and fungus diseases of pip-fruits: Provided the sprayings recommended during the earlier months of the season have been carefully and thoroughly carried out at the given periods, very little trouble, if any, should be experienced from diseases. For codlin-moth, leaf-roller, and pear-slug spray again as directed

in last month's notes. In orchards where woolly aphis, red mite, or leaf-hopper are in evidence spray at regular intervals with either Blackleaf 40, 1 in 1,000, or with lime-sulphur, 1 in 120. Control powdery mildew as directed in last month's notes.

Insect pests and fungus diseases of stone-fruits: In orchards where black aphis, cherry-slug, red mite, brown-rot, and bladder-plum are present spray as directed last month.

Suckering: Remove all suckers from trees—an important work too often neglected.

Cultivation: Keep the soil well stirred, so as to conserve the soil-moisture during this critical period in fruit-development. Trees carrying heavy crops of fruit will require a considerable quantity of moisture to mature successfully the crops they are at present carrying. Cultivation will keep the weeds down.

Marketing: Another fruit season has begun. Canterbury growers will find it to their advantage to study last month's notes under this heading. Order cases and packing-material early, as soon as reliable estimates of the crop can be made.

*—W. K. Dallas, Orchard Instructor, Christchurch.*

### OTAGO.

Reports from various growers throughout the district indicate the prevalence of black and green aphis on stone-fruits. At this time of the year the best remedy is Blackleaf 40, thoroughly applied with plenty of force to penetrate into the curled leaves where the aphis is hidden. A strength of 1–800 is recommended. The addition of about 4 lb. soap to each 100 gallons of spray mixture increases the effectiveness. Apply a second dressing about a week later, as one spraying will not be sufficient to control this pest effectively, and a further spraying may be necessary.

Codlin-moth will be at its worst now. Keep the fruit well coated with arsenate of lead during December and January, and pick off and destroy all infected fruits. Cherry and pear slug will also need checking with arsenate of lead, and a second application may be necessary. Use hellebore powder on ripening fruit, as it does not stain the fruit; 2 lb. to 50 gallons water will be sufficient. Do not allow woolly aphis to take charge of the young shoots on apple-trees. Spray well with Blackleaf 40, at 1–800.

Fungus diseases will need further treatment, especially powdery mildew and black-spot. Lime-sulphur can still be used at 1–120. Care must be taken during hot weather; if very hot use atomic sulphur, 8 to 10 lb. to 100 gallons. Peach-rust will also need precautionary measures. Self-boiled lime-sulphur, 8–8–50, is the safest to use on stone-fruit trees.

Lighten the crop by thinning all overloaded and stunted trees, either pip or stone fruits.

In marketing fruit remember that honest grading and packing gives the best returns. Let the information given on the outside of the package be a guarantee of the contents. Put the choice fruits into trays and crates; second-grade fruit should not be packed in them. Do not allow stone-fruits to stand in the sun after removal from the trees; this is often the cause of sweated and rotten fruit arriving on the market.

*—J. H. Thorp, Orchard Instructor, Dunedin.*

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## THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

THROUGHOUT the main parts of the Dominion January is one of the busiest months for the bees as well as the beekeeper. This is the period when the clover yields the greatest quantity of nectar. It is therefore necessary for the apiarist to put in as much time as possible attending to the requirements of the hives—to see that there is an ample supply of supers and combs for the storing of nectar. Where there is a shortage of these it will be necessary to commence extracting as soon as the combs of honey are sealed over by the bees. It is not necessary to wait until every cell is capped, but it is advisable to see that at least three parts of the comb is covered. If the honey is extracted before it is capped there is a grave risk of its fermenting sooner or later. It is not advisable

to extract during wet or damp weather, as honey, like salt, will quickly absorb moisture, and it is this excess of moisture in honey which causes it to ferment. Many beekeepers prefer to leave the honey in the hives until later on in the summer. This is good policy where ample supplies of drawn combs are available.

In many parts it will still be necessary to take precautions to prevent swarming, but hives containing young queens are not so likely to swarm. When the main honey-flow is on the bees seem to give all their attention to gathering stores, and are not so keen on swarming.

### THICK HONEY.

In many parts of the North Island beekeepers have great difficulty in extracting the honey from the comb owing to its density. This is particularly so with manuka (or tea-tree) honey. Where there is only a small portion of this unextractable honey, it is advisable to put it aside to be used for winter or spring stores, but where a large part of the crop consists of such it is necessary to find means of separating it from the wax in order to market it. In past years the custom has been to press out the honey in a powerful press, but in recent years it has been found that the steam-heated comb-reducers or capping-melters are much quicker and less trouble. In either case it means the destruction of the combs.

Where the steam- or water-heated honey-melter is used it is advisable before using it for the first time to see that it is free from leaks, as unless it is well soldered the shaking it receives during transit from the supplier will frequently cause the joints to loosen. The slightest leak in the machine may ruin the honey. Another matter to be attended to is making sure that the honey and wax, when melted, get away quickly, otherwise overheating will result and the honey will acquire a burnt flavour. Honey can be heated up to a temperature of 155° F. without its flavour being injured to any extent, provided it does not remain at that temperature for more than a few minutes.

### QUEENS.

Many beekeepers will now be receiving the new queens ordered from breeders. Full instructions have been given in recent issues on how to introduce them, but it may be well to warn the beginner not to judge the queen by her appearance. It frequently occurs that a purebred Italian queen will look almost black. One can only judge by her progeny. In the ordinary course her first workers should be freely emerging about four weeks after her introduction. If these are uniform in colour and all have the marking of a pure Italian, then the queen is right, no matter what her own colour is.

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## THE GARDEN.

W. H. TAYLOR, Horticulturist.

### VEGETABLE-CULTURE.

THE supply of vegetables next winter and early spring is largely dependent on the planting that is done during the three or four weeks beginning with the third week in December. Leeks, brussels sprouts, and early broccoli should be out by the end of the first week in January, following with midseason and late broccoli, cabbages, and savoys. These latter are often planted too early; they should not come into use until the weather is cold.

It is a good plan to lift the plants of the brassica family—cabbages, &c.—a week or two before they are to be planted out, and heel them in a plot of well-pulverized soil. A shallow trench should be opened, the plants arranged against the outer wall of the trench in a sloping position, a good watering given, and the trench then filled by digging forward so as to leave a similar trench 8 in. or 9 in. from the first. Proceed in this way till a sufficient number of plants are heeled. About 3 in. from plant to plant will be sufficient. In this position the plants will quickly make new roots, and when transferred to their growing-quarters will require very little care.

When the final transplanting is done, provide a tub with a few inches of water in the bottom, and stand the roots of the plants in the water for an hour or two before planting. When the plants are taken from the tub for planting take a handful of mud from the bottom of the tub and rub it over the bundle of

roots. This will protect them from the sun during the operation of planting. Some people wait for rainy weather for planting, but this is a great mistake. Firstly, the rain may be long coming and valuable time be lost. Secondly, if plants are put out during rain they wilt as soon as the sun comes out. Thirdly, planting in rain is a messy job that takes long in doing. The work can be more expeditiously done in dry weather. The plants get some hold of the soil, and when rain comes they are in a position to benefit by it and rush into growth at once, with no more wilting.

One hears of such methods as making a puddle of clay and cow-manure to dip the roots in. Such methods are quite unnecessary and are a waste of time. The manner of planting is of far greater importance. Most people plant with a dibber. This is a quite efficient implement when the soil is full of moisture, but with some soils (it has serious deficiencies when the soil is dry and especially if it is at all stiff) it is not by any means a good way to deal with plants that have a good stock of roots. The best implement to use is a hoe with a handle about 15 in. long and a narrowish blade about 5 in. deep. Planting requires two strokes; one brushes away the dry crumbs from the surface; the next is driven in the full depth of the blade, and a slight pull to the operator opens a space between the hoe and the soil. The roots of a plant are then inserted in this space, the hoe is withdrawn, and the soil firmed either by a prod with the head of the hoe or with the toe of the boot. This method of planting provides that no loose dry crumbs of soil come in contact with the roots, and avoids the cramped hole made by a dibber, which hole has smooth compressed walls that in some soils become very hard. Lastly, the work is done much quicker with the hoe; five thousand plants can be set out in a day of eight hours by a smart man.

For the purposes of cultivation it is necessary to have the rows quite straight. In the case of small cultivations the rows are usually set by garden-line. For large areas a marker is necessary. A marker is a home-made contrivance consisting of a length of 3 in. by 2 in. timber, with teeth made out of a 3 in. by 1 in. batten, the marking ends being sharpened. A rake-handle with stays of wire is attached to the marker, which has four teeth set at the distance desired. Some guide is necessary for the first row. This may be a line or a straight harrow mark. For the second and subsequent sets of rows the inner tooth of the marker travels down the last drill; thus a four-tooth marker really makes three drills.

Swede turnips should now be sown. Thin the plants when large enough to about 8 in. apart. A last sowing of peas may be made early in January. A medium-height variety or a dwarf should be sown. French and butter beans should be sown for succession. The last sowing may be in February in the North Island and other places not subject to autumn frosts. A sowing in January will be the last in cooler places. Turnips may be sown in small breadth, also lettuce in rows to be thinned instead of transplanting. Marrows, pumpkins, &c., will soon be in strong growth. When the strong runners have extended a yard or so they should be stopped by pinching the points off. This will encourage fruit-bearing laterals. Root crops—carrots, parsnips, &c.—should be thinned as early as possible and the soil kept loose around them.

Leeks should be ready for planting. Very few now plant in trenches—a method that is wasteful of time and space. It is not denied that larger specimens can be grown in trenches, but the greater weight from a given area is secured without trenches, and giant specimens are not really wanted. Good soil that has been deeply trenched is required. Draw a drill as though peas were to be sown, but deeper if convenient, and plant in this drill. Leeks for planting should be 8 in. or more tall. They should not be trimmed, neither roots nor top. Lift the sets with a fork so as not to injure the roots. To plant, thrust a dibber its full length into the soil, and rotate slightly to increase the diameter of the hole. Lower a plant its full length into the hole, then lift it till the crown is level with the top of the hole; this will straighten the roots. Next thrust the dibber two-thirds its length into the soil a few inches from the hole, with the point slanting towards the bottom of the hole. Then bring the handle upright against the plant with a sharp push. This will fill the hole and firm the soil about the roots. Writers in England are advising this plan, but with the difference that they do not fill the hole, leaving it to be filled gradually. This latter plan has the objection that the roots are left loose in the soil. My experience has been that when treated in that way in this country many of them bolt to seed instead of growing. Plant 8 in. apart in rows 18 in. asunder. A little bonedust should be sprinkled in the rows before planting; a portion of it will be carried down to the roots during the operation of planting.

Tomatoes should have frequent attention in the way of stopping waste growth. This should be done while the shoots are small, so that they can be pinched off. This effects a saving in labour and conserves the strength of the plant to fruit-production. Spraying should not be neglected, particularly if the weather be showery or if the plants have been given much fertilizer or manure.

Where mildew is known to occur it will be a wise precaution to spray onions at once with 2–2–40 bordeaux mixture, or with sulphide of potassium, ½ oz. per gallon of water. The latter is the simplest spray, as it requires no preparation, while the bordeaux does, and also requires a resin sticker. The resin sticker is made by boiling together till dissolved 1⅛ lb. resin and 1 lb. washing-soda in 2 gallons water. This is sufficient for 50 gallons of spray mixture. Spraying for onion-mildew is effectual only when used as a preventive. If the disease once obtains a hold it cannot be stopped, except by injuring the crop with the spray; in fact, when the disease gets a firm hold the remedy is more destructive than the disease.

## POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

With the hatching operations all over and the chickens at an age when they do not require almost constant attention the poultry-keeper will now be able to devote more of his time to the ordinary work of the plant. In this connection a matter for first consideration is to thoroughly clean and spray the houses with strong disinfectant as a means of keeping vermin in check. All litter, nesting-material, &c., should be removed before the spraying-work is carried out. It must be remembered that in hot weather these insect pests multiply at an alarming rate, and if constant warfare is not waged against them the stock, especially the young ones, will suffer. The wise poultry-keeper never allows vermin to make their appearance, particularly in the case of the red mite. He realizes that whether they are present in large or small numbers they mean a steady drain on his profits, for a laying-hen cannot be expected to produce a maximum egg-yield if nightly tortured by these blood-sucking parasites. He sees that preventive measures are taken even if there is no sign of vermin present.

When called upon to advise regarding loss of stock and poor egg-returns during my visits of instruction, it is surprising to find the number of poultry-keepers who will give an assurance that their plant is free from vermin, and assert that it is in no way responsible for the trouble, yet when a search is made the place is found to be overrun with them. As an instance, I was recently asked to advise at a place where chickens were dying by the hundred during the brooder stage. I found that the system of feeding and brooding was all that could be desired, and the owner declared at the outset that red mite was unknown on his plant. On making a search, however, the cause of the mortality was made plain. From top to bottom of the brooder-house the red mite was found in every crack and crevice. It was little wonder that the chickens were dying like flies, and in the circumstances it would have been surprising if they had not. Because red mite cannot be seen during the day it is never safe to conclude that it is not present. The mites hide during the day in secluded places and attack the birds by night, and owing to this habit it is to be feared that too often they are responsible for much worry and loss to the poultry-keeper while escaping his observation. The only way to make sure that a house is free from red mite is to dig into the cracks and hiding-places with a penknife. If the dust, &c., is collected on a piece of white paper the mites will be readily seen if present. Strict attention to cleanliness and frequent disinfection are the first essentials in keeping the quarters free from these enemies of the fowl.

### CHICKEN-POX.

Several inquiries have reached me of late regarding outbreaks of chicken-pox. This disease is rarely seen in the South Island, but is common in the North Island, particularly in the far North. It usually begins with yellow crusted nodules of various sizes on the comb and wattles. It is highly contagious; therefore as soon as the disease makes its appearance the affected birds should be isolated, and the quarters thoroughly cleaned and disinfected. The next measure is to get the blood of the birds in good order, not only in the case of diseased birds, but all others

in the flock as well. For this purpose give frequent doses of Epsom salts and sulphur—about 1 oz. of the salts for every twelve birds, dissolved in the water with which the mash is mixed, and a similar quantity of sulphur thoroughly mixed with the dry ingredients of the mash before adding the water. In districts where fowls are subject to this disease periodical doses of salts and sulphur as directed will tend greatly towards rendering the birds immune from the trouble. The diseased parts on affected birds should be daily dressed with carbolized vaseline.

Sometimes the disease is accompanied by diphtheric roup. This takes the form of cheesy matter collecting about the mouth and windpipe, while the breath usually becomes foul. When these two diseases go together and have gained a foothold, there is no telling when the disease is going to be stamped out. In bad cases it is better to kill the fowl and burn the carcase, as one bad attack renders the victim susceptible to further attacks. In addition to the treatment already prescribed, and as a cure, the following is recommended: Take a shallow dish or similar receptacle, fill it with pure kerosene, and dip the bird's beak in this sufficiently deep to cover the nostrils. Hold the bird in this position until it breathes; this will have the effect of drawing the kerosene to the seat of the trouble. Repeat the treatment on alternate days until a cure is effected. Another remedy that may be tried is to place, say, one or two small Condy's crystals on the end of the finger, and after moistening them work them round the bird's mouth until dissolved. This will cause a discoloration of the bird's mouth and also of the finger, which will have a harmless effect on the latter and a beneficial effect on the former. After treating a diseased bird care must be taken that the hands are well disinfected before handling fowls that are free from the disease.

As is the case with most troubles affecting poultry, the only safe policy with chicken-pox is to prevent it. The first essential in this respect is to keep the quarters clean, and by good feeding and proper management maintain the flock in a healthy state, in order that the birds may have the power to resist infection should they come into contact with it.

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## FORTHCOMING AGRICULTURAL SHOWS.

Tuapeka Agricultural Society: Lawrence, 27th December.
Horowhenua A. and P. Association: Levin, 12th and 13th January.
Woodville A. and P. Association: Woodville, 25th and 26th January.
Helensville A. and P. Association: Helensville, 29th January.
Feilding I., A., and P. Association: Feilding, 1st and 2nd February.
Te Puke A. and P. Association: Te Puke, 3rd February.
Pahiatua A. and P. Association: Pahiatua, 4th February.
Clevedon A. and P. Association: Clevedon, 5th February.
Otago A. and P. Society: Dunedin, 9th and 10th February.
Dannevirke A. and P. Association: Dannevirke, 9th and 10th February.
Rodney Agricultural Society: Warkworth, 12th February.
Masterton A. and P. Association: Solway, Masterton, 15th and 16th February.
Northern Wairoa A. and P. Association: Aratapu, 19th February.
Omaha and Pakiri A. and P. Association: Leigh, 23rd February.
Franklin A. and P. Society: Pukekohe, 25th and 26th February.
Hauraki Plains A. and P. Association: Ngatea, 26th February.
Egmont A. and P. Association: Hawera, 2nd and 3rd March.
Morrinsville A., P., and H. Society: Morrinsville, 9th March.
Matamata A. and P. Association: Matamata, 15th March.
Ashburton A. and P. Association: Ashburton, 17th March.
Mackenzie County A. and P. Society: Fairlie, 28th March.
Methven A. and P. Association: Methven, 31st March.
Mayfield A. and P. Association: Mayfield, 31st March.
Oxford A. and P. Association: Oxford, 7th April.
Temuka and Geraldine A. and P. Association: Temuka, 7th April.

*(A. and P. Association secretaries are invited to supply dates and location of their shows.)*

# ANSWERS TO INQUIRIES.

**IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.**

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### DANISH AND NEW ZEALAND COCKSFOOT-SEED.

"WISTERIA," Puaha :—

Can you supply me with the following information: Is Danish cocksfoot-seed superior to Akaroa seed in germination, purity, &c.; can it be procured in New Zealand at the present time; is Denmark a great producer and exporter of cocksfoot?

The Biologist :—

The quality of Danish cocksfoot imported into New Zealand is superior to Akaroa-grown, particularly in regard to germination. Danish cocksfoot averages well over 75 per cent. germination, while Akaroa averaged last year about 55 per cent. The superior quality of the Danish may be attributed to the methods they adopt for the growing of this seed. Their system is to plant or sow in rows sufficiently wide to allow of intercultivation, and there is no doubt that this system results in a splendid-quality seed, and very big crops may be produced. Our system of simply cutting the seed when ripe, and allowing the crop to take care of itself for the rest of the year must result in deterioration of quality and crop. The use of power machines in threshing is also a factor which has influenced the germination of New-Zealand-grown seed, the power thresher being able to beat off the last of the seeds, which are usually immature. When the flail was used such seed adhered to the straw. Before the war regular shipments of Danish cocksfoot were made to New Zealand from Denmark, but export from that country fell off considerably during the war period. A good deal has been imported this year, however.

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### WASHING-OUT COWS.

H. C. THOMSON, Carterton :—

In the article on diseases of live-stock in the *Journal* for October occurs the statement that the only time at which the washing-out of the genital organs of cows is effective is immediately after calving. Does this mean that syringing with disinfectant at any other time is of no use? If a cow which has aborted visits the bull, say, two or three months afterwards, will she infect the bull, and will he in turn infect the rest of the herd? If so, what is the best preventive?

The Live-stock Division :-

The only time at which the womb can be effectively washed out is before it begins to contract. This process begins shortly after calving, and as soon as the animal again becomes pregnant the womb closes, after which no washing-out process can reach it unless force is used. Where disinfectant is forced into the womb of a pregnant animal abortion usually takes place. The diagram in the Department's Bulletin No. 20 ("Contagious Abortion," &c.) fully illustrates this. A heifer which has aborted and has been treated for abortion at the time should be again washed out, as far as is practicable, two or three days before being sent to the bull. There would then be small chance of his becoming affected thereby; but in any case it is a wise precaution to treat him occasionally as recommended in the bulletin. Proper sanitary attention to cows, both before and after calving, would not only assist to check abortion, but would reduce septic metritis to a minimum.

### SWOLLEN UDDER IN COW.

A. DYER, Tauhoa :—

I have a cow which came in five days ago, and at that time appeared well. Since then her udder has become very much swollen and hard. The animal will not feed, and appears to be in pain. I have applied hot water very frequently, and rubbed with vaseline. Please advise me as to how the trouble should be treated.

The Live-stock Division :—

Such cases are best treated by fomenting the udder two or three times a day. After the fomentation the following liniment should be well rubbed in: Liquid extract of belladonna, compound liniment of camphor, soap liniment, mixed in equal parts. The mixture should be well shaken before it is applied. In these cases the inflammation is generally so severe that it affects the system and puts the animal off her food, and it is advisable that a purgative should be given as follows: Epsom salts, 8 oz. to 10 oz.; ginger, 1 oz.; raw linseed-oil, 1 pint—administered in 2 quarts of thin oatmeal-gruel.

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### PRODUCTION OF SEED OF MANGOLDS, CARROTS, ETC.

"REPRODUCTION," Spreydon :—

Will you kindly give me some information with regard to the successful growing of seeds of mangold, carrot, swede, and broccoli? I have some very fine specimens of mangolds and carrots, and wish to reproduce from them.

The Biologist :—

All the plants mentioned are more or less subject to cross-fertilization, and therefore mixed strains are likely to result if more than one variety of mangold, carrot, or swede be grown in or near the same locality. Swedes and broccoli must not be grown together for seed, as each one is likely to fertilize the other. A distance of at least half a mile should separate each variety of carrot, mangold, and each species or variety of the turnip family. Single-variety crops of carrots, mangolds, or swedes, however, may be grown for seed side by side. In the production of this type of seed selection of the best bulbs throughout the crop is necessary to ensure a good strain of bulb being maintained. In all our root crops the tendency is to revert to the original wild non-bulbing form, and hence the necessity of pulling out from a seed crop all those bulbs of an inferior type. The crop could, of course, be gone through carefully, and these inferior bulbs removed, but in the setting-up of a good strain a start should be made only with bulbs of a good shape and uniform type. These are best lifted and transplanted to a nicely sheltered spot. Birds are very destructive on small seed crops of the turnip family. The seed produced from these selected transplanted bulbs would form the seed used in the production of the next year's root crop, which would be let go for seed as it stood in the field. Prior, however, to the crop running to seed the crop should be gone through carefully and a further selection of the best bulbs made. These bulbs again are lifted and transplanted to the sheltered spot, and they will once more give the seed for sowing the next year's crop, the ordinary crop being harvested for seed that is used by the trade for ordinary feed-crop producing purposes.

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### FAILURE OF CONCEPTION IN COW.

"FARMER," Tokoroa :—

We have a young cow which had her first calf last year but is not coming in this season. The bull has been running with her all the winter. She does not seem to come on regularly, the period being sometimes two weeks and sometimes up to six weeks. We shall be glad of advice to enable our ensuring her coming in next season.

The Live-stock Division :—

We would advise you to keep the animal away from the bull for a period of, say, three months. About ten days before being put to the bull she should be washed out with a solution of corrosive sublimate and water, one tabloid to a quart of water. Again, when the cow comes in season it would be advisable to wash her out with a solution of bicarbonate of soda (baking-soda), one tablespoonful

of soda to a gallon of water. It should be observed that certain cows fail to get in calf despite any treatment that may be applied. Such animals had better be fattened and sold as beef.

NOTICE.—An answer cannot be given to "V. D. M.'s" inquiry regarding grass and fodder crops unless full surname is furnished.

## LIST OF QUALIFIED VETERINARY SURGEONS.

THE following list of qualified veterinary surgeons known to be residing in New Zealand is published for the guidance of stockowners and for general information. In the event of the name of any properly qualified veterinarian being omitted, it is requested that he communicate with the Editor, giving particulars of his qualification, in order that the necessary steps may be taken for the inclusion of his name in the next published list.

*Ashe, G. G., M.R.C.V.S., Timaru.
*Barnes, A. W., M.R.C.V.S., Hastings.
*Barry, W. C., M.R.C.V.S., Christchurch.
Bayley, A., M.R.C.V.S., Wanganui.
Begg, W. F., M.R.C.V.S., Te Awamutu.
*Blair, W. D., M.R.C.V.S., Invercargill.
*Blake, T. A., M.R.C.V.S., Masterton.
Brodie, A. M., M.R.C.V.S., Hastings.
*Broom, G., M.R.C.V.S., Gisborne.
*Burton, S., M.R.C.V.S., Hamilton.
Cockroft, J. E., M.R.C.V.S., Feilding.
*Collins, W. T., M.R.C.V.S., Wellington.
Crossley, F., M.R.C.V.S., Palmerston North.
*Cunningham, T., M.R.C.V.S., Oamaru.
*Danskin, J., M.R.C.V.S., Dunedin.
*Edwards, W. H. H., M.R.C.V.S., Auckland.
*Elphick, E. E., M.R.C.V.S., D.V.H., Wellington.
Glover, F., M.R.C.V.S., Hamilton.
*Hickman, A. J., M.R.C.V.S., Auckland.
Hankin, F. H., M.R.C.V.S., Point Chevalier.
*Haugh, P., M.R.C.V.S., Petone.
*Howard, E. C., M.R.C.V.S., Wanganui.
Johnson, A. A., F.R.C.V.S., Christchurch.
*Kerrigan, J., M.R.C.V.S., Christchurch.
Kyle, H. S. S. G.M.V.C. (Melb.), Templeton.
*Lyons, J., M.R.C.V.S., Auckland.
*Marsack, H. L., V.S. (Ontario), Auckland.
Marshal, D., M.R.C.V.S., Balclutha.
Martin, H. E., M.R.C.V.S., Christchurch.
McLeod, J., M.R.C.V.S., Christchurch.
*Meade, R. H., M.R.C.V.S., Palmerston North.
Miller, J., M.R.C.V.S., Invercargill.
Neale, C. R., M.R.C.V.S., Hawera.
*Paterson, A. M., M.R.C.V.S., Timaru.
Quinnell, W. C., M.R.C.V.S., Wellington.
†Reakes, C. J., M.R.C.V.S., D.V.Sc., Wellington.
*Reid, H. A., F.R.C.V.S., D.V.H., F.R.S.E., Wellington.
Ring, W. C., V.M.D. (Penn., U.S.A.), Ellerslie.
Siddall, E. L., M.R.C.V.S., Opotiki.
Simpson, C. S., M.R.C.V.S., Auckland.
*Snowball, W. D., M.R.C.V.S., Dunedin.
*Stafford, J., M.R.C.V.S., Christchurch.
‡Stapley, W., M.D., D.V.Sc., M.R.C.V.S., Cambridge.
Taylor, Alex., M.A., M.R.C.V.S., Lincoln.
Taylor, J. B., M.R.C.V.S., Waverley.
Taylor, W. G., M.R.C.V.S., Stratford.
Ward, J., M.R.C.V.S., Katikati.
*Wood, R. B., M.R.C.V.S., Waitara.
*Young, A. R., M.R.C.V.S., Wellington.

* Officers of the Live-stock Division, Department of Agriculture. † Director-General, Department of Agriculture. ‡ Not now practising as a veterinary surgeon.

## EXPORTATION OF WOOL.

THE Comptroller of Customs notifies, under date 19th November, 1920, that the Minister of Customs has granted general permission for the exportation to any destination of (*a*) greasy or scoured wool clipped on or after the 1st July, 1920, and (*b*) sliped or washed skin wool. If any person wishes to export any greasy or scoured wool clipped prior to the 1st July, 1920, application should be made to the Comptroller of Customs, Wellington, stating the number of bales desired to be shipped, the marks and numbers, the date on which it was clipped, and, if possible, the name of the exporting vessel and the probable date of her departure.

*Albany Fruit Show.*—The annual show of the Albany Fruitgrowers' Association will be held at Albany on 19th February, 1921.

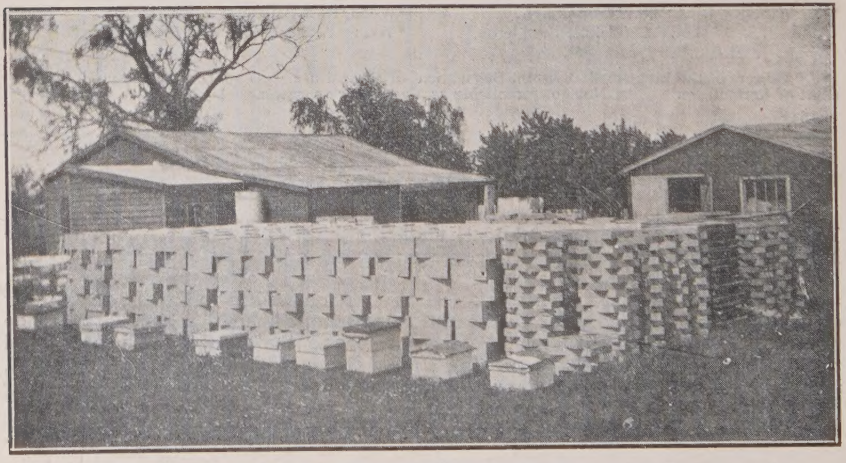
*Sheep-skins and Pelts.*—The prohibition of the exportation of sheep-skins and pelts has been revoked by Order in Council dated 22nd November, 1920.

# THE SEASON'S LAMBING.

FOLLOWING are complete estimates of the current season's lambing, computed from estimated average percentages of lambs dropped, furnished by the Department's Inspectors of Stock in the various districts. Corresponding figures for the three previous years, together with the actual numbers of lambs tailed, are also given for comparison.

| Year. | Number of Ewes put to Ram. | Estimated Average Percentage of Lambing. | Estimated Number of Lambs. | Actual Number of Lambs tailed. |
|---|---|---|---|---|
| | | NORTH ISLAND. | | |
| 1920 .. | 5,838,704 | 87·95 | 5,135,524 | .. |
| 1919 .. | 6,311,797 | 81·57 | 5,148,779 | 5,120,000* |
| 1918 .. | 6,846,049 | 85·62 | 5,881,682 | 5,734,594 |
| 1917 .. | 7,475,418 | 87·50 | 6,539,033 | 6,292,838 |
| | | SOUTH ISLAND. | | |
| 1920 .. | 5,729,845 | 80·20 | 4,595,426 | .. |
| 1919 .. | 5,996,709 | 72·23 | 4,331,883 | 4,326,385 |
| 1918 .. | 6,175,981 | 76·50 | 4,728,391 | 4,750,777 |
| 1917 .. | 5,784,751 | 87·25 | 5,072,307 | 4,901,329 |
| | | DOMINION. | | |
| 1920 .. | 11,568,549 | 84·11 | 9,730,950 | .. |
| 1919 .. | 12,308,506 | 77·02 | 9,480,662 | 9,446,385* |
| 1918 .. | 13,022,030 | 81·50 | 10,610,073 | 10,485,351 |
| 1917 .. | 13,260,169 | 87·50 | 11,611,340 | 11,194,167 |

* Approximate.



SIXTEEN HUNDRED 12-FRAME HIVE-SUPERS MANUFACTURED BY MR. W. LENZ, MASTERTON, FOR USE IN HIS APIARIES THIS SEASON.

*F. A. Jacobsen, photo.*